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NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORTS 1877.

I–VIII

LONDON:
T. P. NEWMAN, PRINTER, BOTOLPH LANE, EASTCHEAP.

1878.

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NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORT, 1877.

THE request, made in the spring of the present year, for observations relative to insect injuries to the food crops, has been responded to far more cordially than could have been expected. Observers, both scientific and practical, have come forward to give the benefit of their experience, and the thanks due for their kind co-operation are offered both to those whose names are appended to their observations and also to the contributors of shorter notes. In the case of the *Colias* entries a few are taken by kind permission from those of the phenological observers of the Meteorological Society.

Whether much or little, those who will give the benefit of their knowledge in diminishing the great yearly loss from insect waste are doing good service to the country; and this first year's return shows how much may be gained by continuing the observations for the time which would be requisite to form fairly complete notes of treatment found successful generally, with the modifications required by each year's peculiar weather, or by soils and climates varying as widely as the range from Banff to South Devon.

The returns sent in are carefully preserved for reference as to details: for present use they give the following notes of remedies found successful in various districts; of presence or absence of injurious insects (information equally serviceable in either case, when accompanied by that of coincident circumstances); and more detailed observations of the great insect feature of the year—the extraordinary outburst of *Colias Edusa*, which, though little important as a "farm pest," was selected for observation, from its intermittent appearances possibly throwing light on the cause of other occasional visitations of a more serious nature, as those of the *Athalia spinarum* (Black Jack),

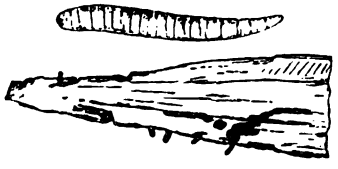
or the devastating swarms of *Aphides*, as about the 25th of July, 1869. This year the weather influences, taken in the main, have been those of a drenching and mild winter, followed by an intermittently wet and sunless summer, and a dry early autumn, again followed by great rainfall.

The reports of insect observations are:—

1. **Halticidæ**, *var.* sp. Turnip Flea Beetle, or "Fly." The absence of this insect is noted at Inverurie, Aberdeenshire; in Essex, and in the Exeter and South Devon district in connection with wet weather; and its slight presence at Maxwelltown, Dumfries, where the summer was unusually cold and wet; whilst at Strathfield Turgiss, Hants, where the rainfall was only about half that of South Devon, as taken at Teignmouth in May, the Fly was then abundant. At Knebworth, Herts, an example is given of the value of surrounding weeds to the farm insects as a means of support till the crops are ready for attack, in the appearance of the Turnip Fly, mentioned by Mr. Benj. Brown as appearing first on Charlock in fields where Turnips had grown the previous year, and then causing great injury to the Kohl Rabi and Turnips; this especially in dry weather. In North Lancashire, where vegetation was unusually backward at the end of May, the Fly was likewise very injurious; and near Marlborough, where a great outburst in one locality came with the warmth of the later weeks of June, we are obliged to Mr. Tanner, of Ogbourne Maizey, for details of a remedy, which he mentions as having tried successfully in previous years. The plan followed is to drive a large flock of sheep on the attacked field early in the morning, whilst the dew is still on the leaf, and with the help of a dog to keep them in constant motion, and well up in a body, so as to tread over all the field in turn. Treated in this way no injury is done to the crop; but if much ground has to be gone over it should be taken on different days, as it would injure the sheep to keep them long without food, or to harass them by the continued driving early in the morning. In this case the extent of ground was thirty-seven acres, and from four hundred to five hundred sheep were put on. The fly, when I saw it at the end of June, was so strong as to threaten clearing the crop, and it had almost been decided to plough it up; but this treatment, which embodies disturbing and killing many of the insects by the treading, and which also makes the leaves distasteful for oviposition, both by rubbing of the sheep and the coat of dust scattered in dry weather, saved the plants, and was followed by a good crop. In my own garden, near Isleworth, where the Fly had been present, and some-

times very destructive, during the last three years, I have found simply sprinkling the young Turnips with road-dust preserved them entirely from injury. Mr. Rolfe, writing from Welbeck Abbey Gardens, near Worksop, mentions the Turnip Fly as more abundant than usual, but partial in its attack, the crop escaping in some places, whilst in others, under apparently similar circumstances, it was nearly or entirely destroyed. The preceding crop is noted as being generally Wheat, the soil strong loam, and the manure usually from the farm-yard. Further information, whether variation in the presence of Fly followed variation in these respects, would be of interest.

2. Anthomyia ceparum. Onion Fly. This was noticed by Mr. James Kaye as particularly destructive near Bury, in Lancashire. The eggs of the Fly were first observed on the 21st of May, laid where the leaves divide, the larvæ hatching after a few days, and feeding on the seed-blade till they reached the root, then striking into the bulb, if formed, otherwise into the root, and soon destroying the plant. The soil was mostly light and in high cultivation, and pulverized gas-lime scattered amongst the Onions was found to act well in keeping off the insects. Watering the Onions with the liquid from pigsties, run into a tank specially arranged for the purpose, was found to answer still better. Several of the residents who adopted this plan secured good crops, whilst in the cases where it had not been followed the crops were for the most part destroyed. Near Isleworth but little injury was noticed amongst the Onions from the Fly, though in 1876 it had been reported as very destructive; and the bulbs this year were in some cases much diseased from other causes.



Psila Rosæ.

3. Psila Rosæ. Carrot Fly. Little noticed, except at Maxwell-town, Dumfries, where Mr. Robt. Service mentions it as first observed on July 10th, and as being every season the cause of much loss, two-thirds of the crop being destroyed on light gravelly soil. In moss and clay lands it does no damage. In gardens, a preparation of a wine-

glassful of paraffin oil to a gallon of water destroys the insects, but kills the crop also if applied in dry weather. Mr. Kaye mentions, from Bury, that in dry seasons he has found watering the Carrots through a fine-rosed watering-can keeps them clear from rust, if thoroughly done; this probably being beneficial by the stimulation of growth, which is usually a great preventive of insect attack.

MAMESTRA BRASSICÆ.

4. Mamestra Brassicæ. Cabbage Moth. Is mentioned by Mr. Edw. Parfitt as being plentiful at Exeter, though late in appearance, and not so destructive to the crops as in the dry seasons. At Bury, Lancashire, it is described as a "regular pest." In other localities it is little noted.

PIERIS BRASSICÆ.

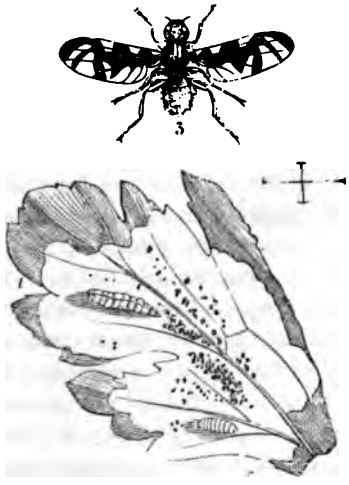
5. Pieris Brassicæ. Cabbage Butterfly. Owing to the ungenial spring this Butterfly was apparently later than usual in appearance. It was first observed on the 25th of May, near Maldon. At Isleworth, *Pieridæ* were out on the 25th, but the first *P. Brassicæ* was not noticed till the 29th of May; and the amount of appearance of Cabbage Butterflies varied much with the amount of shelter provided for the previous stage of pupation. In the neighbourhood of Isleworth, where the main field-crop of the district is of different kinds of Cabbage, the proportion of shelter is small to the amount of ground; whilst at Marlborough the Rev. T. A. Preston mentions the large numbers to

be found infesting sheltered gardens. A search under dry eaves, rough boardings or palings, and in the sheltered nooks which abound in garden ground, but are comparatively absent in open-field cultivation, will at times bring scores and hundreds of pupæ to light, and serve to diminish the pest appreciably. At Welbeck Abbey, N. Notts, the first specimen was noticed by Mr. Rolfe, on the 22nd of May, the general appearance of the vernal brood occurring from the 3rd to the 24th of June, and of the larvæ from the 27th of June till the end of July, the number of imagos, and more especially of the larvæ, being less than in the two preceding years. The autumnal brood (which in 1876 had been numerous and destructive) was scarce and late, the appearance of imagos ranging from the 12th of August to the 15th of September, that of the larvæ from the end of August to the end of September, and little injury being caused. The weather is noted as being exceptionally cold, inclement, and sunless throughout the summer, until the second week in September.

AGRIOTES OBSCURUS.

6. **Agriotes,** *var.* sp. Wireworm. At Bury, Mr. Kaye mentions that a solution of carbonate of soda, in the proportion of about two ounces to sixteen quarts of water, applied three or more times from the beginning of May, to the beginning of June, is found a good way to clear the ground. At Knebworth, Mr. Benj. Brown notes Wireworm (*Agriotes obscurus*) in considerable numbers, as attacking the Barley sown after dead fallow. He drilled Lawes' Turnip manure with the bulk of the field, and on this the Barley grew rapidly away from the Wireworm; whilst on two pieces (each seven feet wide), left across the field without the manure, more than half the plants were destroyed. This difference is noted as having been observed on previous occasions. On the 28th of April Mr. Edward A. Fitch noticed an attack of Wireworm on somewhat more than thirty acres of Barley, which had been sown towards the end of March, after summer fallow, near Maldon, in Essex; whilst Barley sown in the same field on the 16th and 17th of April, and not then up, was not afterwards affected by it. This land he had manured with sixteen to

eighteen cartloads of farmyard cake-fed dung per acre, put on after harvest. In another field of fourteen acres of Mangolds, sown late in April, which came up well, but grew slowly on account of bad weather, Mr. Fitch noticed the Wireworm abundantly in May. The ground in the previous season had been in Turnips, and Mangolds (which were destroyed by surface caterpillars, and other insects), and subsequently well cultivated throughout the spring. Six acres were manured with fourteen loads of cake-fed dung, and the whole with five hundredweight per acre of Lawes' Mangold manure, but no difference was observed in the degree of Wireworm attack. It is noticed round Maldon that the Wireworms, which (as far as is known) are usually the larvæ of *Athoüs hæmorrhoidalis*, appear more troublesome on the heavy land after a fallow. Amongst root crops the remedies used are furrow-hoeing, horse-hoeing twice in a place, hand-hoeing close to the rows, and then chopping out to stop the Wireworm's working in the drills; but, however it may be done, stirring the land well is considered the best remedy with root crops. Amongst corn crops rolling with a heavy roller, or, if possible, on the lighter soils, with a Crosskill's clod-crusher, is the usual remedy. In one case the object is to solidify the surface, and so stop the Wireworm's working; in the other (the root and green crops), to stimulate growth in the young plants, besides disturbing the larvæ.



TEPHRITIS ONOPORDINIS.

7. Tephritis Onopordinis. Celery and Parsnip Fly. Scarcely noticed. At Maldon no traces were observable up to November 7th;

afterwards there was a very slight appearance; this being almost on the same spot where the Celery was greatly injured last year by *Tephritis* ravages. At Isleworth it is only noticed as appearing in one garden, after the dry weather in October. Scarcely to be found at Welbeck Abbey, N. Notts, though plentiful last year.

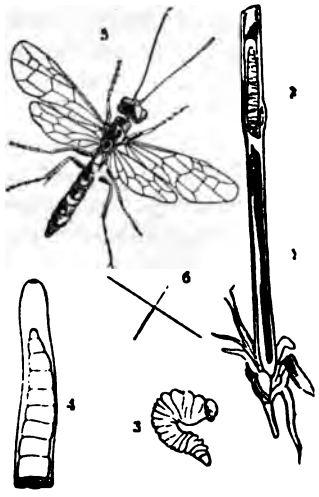
ATHALIA SPINARUM.

8. Athalia spinarum. Turnip Sawfly. Little noted. Absent in Essex, and also round Isleworth. At Inverurie Mr. Tait mentions that he has very rarely seen the larvæ, and not during this year. Observations on this insect are particularly desirable.

CHLOROPS TÆNIOPUS.

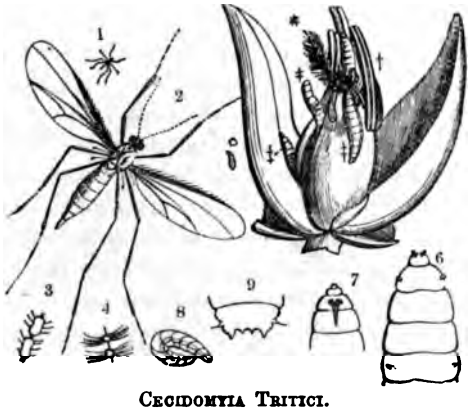
9. Chlorops tæniopus. A small quantity near Maldon; and a

few stems (also of Wheat) channelled by some species of *Chlorops* in a neglected, clayey field, near Isleworth,—the only returns.



CEPHUS PYGMÆUS.

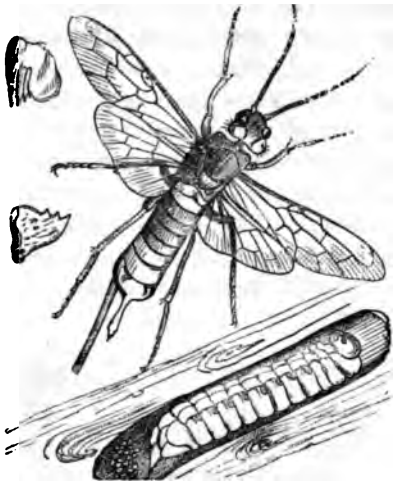
10. Cephus pygmæus. Corn Sawfly. Not noticed.



CECIDOMYIA TRITICI.

11. Cecidomyia Tritici. Wheat Midge, or Red Maggot. Is mentioned as unusually abundant at Knebworth, Herts, and unusually absent in Essex. It is observable that in Essex the chaff is used for cattle, consequently destroyed with its contents, whatever they may be; whilst the custom prevalent some few years ago (probably still), in some parts of the West of England, of throwing the chaff in heaps

to decay, provided the Maggot with good shelter during the winter to develop in the following June, and so infest the neighbourhood. Any observations as to quantity of Red Maggot in summer, varying with shelter provided for it in winter, would be very desirable.



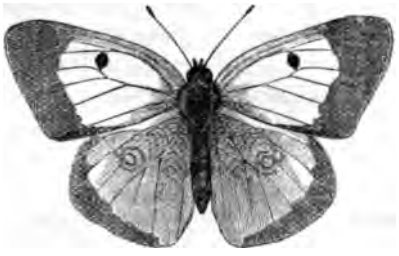
SIREX GIGAS.

12. Sirex gigas. Not uncommon this year. Captured on the 17th August, at Great Cotes, Lincolnshire (a rare insect in that district).

13. Asilus Crabroniformis. Hornet Fly. Was observed by Mr. Parfitt on the 13th of August, as plentiful, at Prawle-Heads, and the adjoining high-lands on the South Devon coast, amongst sheep and cattle, always settling on the excreta of the latter; and on the 1st of September it was noticeable in a pasture field, near Isleworth, the exposure and weather being warm and sunny.

14. Colias Edusa. Clouded Yellow Butterfly. This—the great appearance of the year—is not observed at all in such few localities of the North-East of Scotland as we have notes of. It was first seen near Dumfries, early in June, but not noticed in any quantity till August at the points of observation in Cheshire, Herefordshire, and Lincolnshire; whilst across the South of England it was generally observable from June till October, the proportion of males and females varying much in different localities during August, and possibly giving a clue to next year's amount of appearance; whilst

the frequent death of the larvæ, when feeding on various Clovers and Trefoils, is also of interest relatively to its permanent settlement. The absence of the *Colias Edusa* is noted at Banff by Mr. Thomas Edward; also at Inverurie, Aberdeenshire, by Mr. Tait, although one specimen is recorded by him (in the Scot. Nat.) as seen at Harray, Orkney, on the 19th of June. At Maxwelltown, Dumfries, it appeared on the 3rd of June in fair numbers, after an absence of sixteen years, but was confined to Clover fields, sown out in the spring of 1876. In Cumberland it was seen in some numbers at various places, including Workington, where it had not appeared for forty years previously; and it extended up to the Scottish border. At Darlington, Durham, a few were seen up to the 1st of October. Near Northwich, Cheshire, Mrs. Leathes records the *Edusa* as being first represented, on June 20th, by a much-injured female specimen, others only beginning to appear about the 11th of August, and continuing till the beginning of

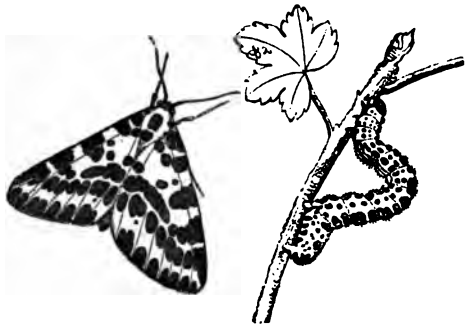


COLIAS EDUSA.

September. They are noted as very abundant, and as not having been seen in the neighbourhood for many years, and never in the great numbers of the present season. The *Edusa* is also recorded as numerous during the summer throughout Cheshire. At Bishop's Frome, Hereford, the Rev. H. L. Graham gives them as rather common during August and September, only one specimen having been observed by himself in the neighbourhood in previous years. Mr. Rolfe notes one specimen only, as observed at Welbeck Abbey, N. Notts, on September 8th; but that a little further south, and at Nottingham, it was more abundant, several being taken, both of the vernal and autumnal broods. At Great Cotes, Lincolnshire, the chief appearance of the *Edusa* is noted by the Rev. J. Cordeaux, on August the 17th; out of forty specimens captured, three only being females. Near Norwich we have notes of its occasional appearance, in the latter part of August, from the Rev. A. S. Ormerod; and it was also observed on the 27th of September.

At Knebworth, Herts, they are noted by Mr. Benj. Brown as first observed on the 4th of June; on the 21st a specimen was seen ovipositing on Trefoil; the larva hatched on the 29th, and fed a few days on White Clover, but then died. The second brood began to fly on the 30th of July (one fresh from the chrysalis being taken on that day), and the numbers continued to increase till the middle of August, a few remaining till the 2nd of October. Near Maldon, Essex, Mr. Fitch's almost daily notes show the imagos as first observed on the 6th of June, and eggs laid the same day on Trefoil, which hatched on the 14th, the first pupa being observed on the 9th of July; eggs of the second brood, laid on the 29th of July, hatched on the 7th of August, and pupæ were observed from the 12th to the 29th of September. The presence of the butterfly was noticed on eighteen days from June 6th to July 2nd, and (after its absence during the following twenty-eight days of July) it was again noticeable on the 30th, and continued, with the exception of the 10th of August, and three other days, till the 1st of September, the appearance not wholly ceasing till the 6th of October. Of the hundred and six imagos bred by Mr. Fitch, from the 21st of July to the 15th of August, forty-nine were males, fifty-seven females; those hatched during the first few days being only males, those during the last few days only females. At Isleworth I observed the butterfly first on the 15th of June, and on the 20th they were moderately plentiful, and continued (but only as scattered specimens, or a very few seen near together) throughout the warm weather. Of a few eggs sent me by post the larvæ hatched, and fed on young Clover leaves, but all died in the course of two or three days. A few specimens of the *Edusa* had been seen in the district in the previous year. At Addington, Winslow, Bucks, Mr. J. Matheson notes the appearance of the butterfly in some numbers in August, continuing till the 6th of September (the date of the observation); two specimens only, a male and a female, having been observed in the previous twenty-three years, these appearances years apart, and the latest in 1868. At Strathfield Turgiss, Hants, the Rev. C. Griffiths gives the earliest of any of the noted dates of appearance; this was on the 25th of May; the butterflies subsequently occurred in profusion in July, and were common in August, and—as at Great Cotes—there was a great preponderance of males, out of one hundred and fifty captured only four being females. The butterfly is also mentioned by Mr. W. Buckler as in great quantities near Emsworth, Hants, in June. At Marlborough, Mr. Manders notices the first appearance on June 9th; the last, as far as known, not later than October 2nd; the greatest amount on August 24th, nearly all the imagos being female: one specimen was observed to lay two eggs on separate plants of Trefoil,

these being of a light yellow when laid, turning before hatching to a deep orange; but, as noted in some other cases, the larvæ died a few days after hatching. A much-worn specimen of the variety *Helice* was captured in the neighbourhood on the 20th of August; and other specimens of this variety were noticed. In the Exeter and South Devon district the *Edusa* was first observed by Mr. Edw. Parfitt, on the 7th of June, and is noted by him as literally swarming in the fields from June till September, especially on Barley, near Prawle-Heads, and in such numbers on Scabious flowers that several specimens could be taken with one sweep of the net. Fresh specimens, as if newly hatched, were still to be taken in the middle of October; and two of the variety *Helice* in good condition were captured near Exeter, about the 20th of November. At Chagford, on Dartmoor, the most south-westerly of the stations observed, Mr. W. H. Grattann notices the prevalence of the *Colias Edusa* wherever he went, whether amongst hedges, or in the fields, or on the moor itself.



ABRAXAS GROSSULARIATA.

15. Abraxas grossulariata. Gooseberry Caterpillar. Is noticed as little observed near Northwich, by Mrs. Leathes; also as little present in Essex, or in the South Devon district. At Maxwelltown, Mr. Service mentions it as not destructive to the Currants or Gooseberries, in fact rarely seen on the bushes; but that the leaves of the white Ribes are every year stripped by the caterpillar. Mr. W. Tait notes it as being as yet absent in the immediate neighbourhood of Inverurie, Aberdeenshire, although it is plentiful on various sides, at distances of from five to seven miles; the circumstances accompanying this difference of appearance would be well worth noting. Near Isleworth there was no appearance of the caterpillar in my own garden, where the bushes have the soil well stirred beneath them;

but at about a mile distance it was troublesome. A mixture of lime and soot—thrown on the bushes in damp weather (so that it may adhere), in autumn—is found a good remedy.

16. Neuroterus lenticularis. The Common Oak Spangle. Is noted as plentiful in South Devon; but round Isleworth it has been so enormously abundant on some trees as to weigh down the foliage and cause premature withering. In Essex it has been less abundant than usual, many Oak-stubs being without a spangled leaf this year, on which they had been plentiful in 1876.

Amongst remedies for attacks of Injurious Insects beyond those mentioned in the list, Mr. W. D. Cansdale, of Witham, Essex, mentions an application which he has found successful this year in freeing his Asparagus from a bad attack of the *Crioceris asparagi* (Asparagus Beetle). The mixture consists of half a pound of soft-soap, quarter of a pound of flower of sulphur, and about the same quantity of soot, well mixed together in a pail of warm water. In this the infested shoots were dipped; and on inspection the next day it was found to have cleared the larvæ. The plants were syringed afterwards with warm water (merely to clear off the dirt left by the dipping), and soon resumed a healthy appearance, and were thus saved from an unusually severe attack; the *Crioceris*, when brought under treatment, being present on almost all the plants and stems, and noticeable by thousands in the larval stage, as well as in the egg.

In my own garden, near Isleworth, I stopped what was becoming a destructive attack by syringing the plants with warm water, just bearable to the hand: this sent off the larvæ, or loosened them so as to fall to a shake; and throwing soot liberally through the damp shoots to the ground destroyed the fallen grubs. This treatment repeated once or twice in the course of the season completely saved the plants, and the soot gave a luxuriant and healthy growth.

Mr. Tait draws attention to unusual injury to the Cauliflower and Turnip crops, round Inverurie, from galls on the root, much of the Cauliflower crop and nearly all the Turnips in some fields being lost from this cause.

Similar galls, produced by *Ceutorhynchus sulcicollis*, are excessively prevalent in the Cabbage-growing district round Isleworth, and information as to means of lessening the attack would be desirable. As the weevil grubs leave the galls, to undergo the pupal change in earth chambers little below the surface of the ground (and have

remarkable endurance, either of prolonged stay in the gall or of premature ejection from it), the plan of leaving the galled Cabbage stumps undestroyed, or of lightly burying them, is a sure means of increasing the numbers of the beetle. Reversely deep digging and change of crop mitigate the evil; but the knowledge of some dressing calculated to deter oviposition in the seed-beds would be very serviceable. Mr. J. Chambers (nurseryman), of Hounslow, informs me that he finds throwing road-scrapings thickly amongst the seedlings to act well in keeping off both Cabbage Weevil and Cabbage Fly maggots, and to be beneficial to the plants as manure.

For the coming season aid has already been kindly promised from observers in various quarters, and it is hoped those who have now given the benefit of their experience will kindly continue their assistance. Few but those practically acquainted with the subject know the great service that is being rendered in discovering the causes of the great insect attacks to the food crops, so that they may be counteracted or nipped in the bud, rather than an attempt made to meet them when the mischief is at its height, and too often past cure; and for this purpose notes from practical men, such as have now come forward, would, if they would kindly favour us with them, in a very few seasons give a mass of information of great working value.

The same list of species will stand for another year (that further information regarding treatment under various circumstances may be gained); but should observers meet with any extraordinary insect appearances, either injurious or otherwise, full details will be serviceable. The remedy for the pest when fairly present (if it is still available) is a great point gained, but almost equally so is any information why it is there at all. We have some knowledge of how particular weeds and preparations of soil, certain weather and kinds of shelter, act on insect life; but we need to know more of these, and also of the power of the plant itself in various states of health for resisting attack, as shown in what is termed "growing past" or "away" from the infesting insect.

It is obvious that a healthy plant is not as soon dragged down by exhaustion of its juices as a weak one, but beyond this it appears as if certain states of the vegetable were requisite to keep the feeder on it in health. In the case of the Celery Fly the grubs inside the leaf-blisters may be watched for weeks—healthy progress in fine weather alternating with disease or death from diarrhœa in rain, apparently from the more succulent nature of the food; and young Cabbage attacked by *Aphides*

may be brought round by such liquid stimulants as will drive on growth luxuriantly, the improvement in this case being apparently only from the nature of the plant juices, as the rapid succession of generations of *Aphides* would, if their pasturage suited, keep pace with its increase. The frequent coincidence of Turnip Fly with drought is another instance of the same principle, and how far it may go would be well worth knowing practically.

The abnormal presence or absence of insects is a point on which the notes of the *Colias Edusa* for this year may throw light in the coming season. The remarkable difference in quantity of the sexes observed at various stations may be followed by coincident variety of appearance next year; and the death of the larvæ on Clover, although one of the plants that the *Colias* mainly affects, is another interesting point.

The special injury caused by insects not usually hurtful, being rendered so by their multiplication, is also illustrated this year by the many acres of Mustard and Turnips, in Cambridgeshire, which have been destroyed by the *Phædon betulæ*, a chrysomelideous beetle, abundant on cruciferous plants, but not generally destructive.

Any notes of insect presence or absence, with their coincidences, will be of service; and observers are requested to forward any observations they will be good enough to take, either as they occur or during October, to the Rev. T. A. Preston, The Green, Marlborough, Wilts; or to E. A. Fitch, Esq., Maldon, Essex; who will be happy to give every information in their power. The sheets for entry of Observations, and pamphlet of notes for observers of Injurious Insects, will also be sent by them on application; or by Mr. T. P. Newman, 32, Botolph Lane, Eastcheap, London, E.C.; and I may be permitted to add that though, from having for many years devoted myself especially to the study of Economic Entomology in its practical bearings, the notes have this year been placed in my hands for arrangement, yet it would give me great pleasure should any more skilled observer come forward to aid in what is a matter of great utility to us all.

E. A. ORMEROD.

Dunster Lodge, near Isleworth,
London, *December, 1877.*

T. P. NEWMAN, PRINTER, 32, BOTOLPH LANE, EASTCHEAP, LONDON, E.C.

NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORT, 1879.

LONDON:
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1880.

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NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORT, 1879.

In 1878 it appeared from the observer's notes that a moist and mild winter had been followed by luxuriant vegetation, and unusual absence of any great amount of insect damage. This season the case has been different. The weather characteristics of the observer's year, beginning with November, 1878, have been temperature below the average, and rainfall above the average, with little sunshine; and the returns show insect attack fully up to the usual amount, and insect presence often exceeding it. The unusual cold of the winter and the depth to which the frost penetrated the ground do not appear to have acted prejudicially on larvæ subjected to them, either at the time or in subsequent development; and the only cases in which the weather appears notably to have had effect in ridding us of insect attack is where the persistent rainfall or the tremendous downpour of summer storms have fairly swept the insects from the plants, or in some cases of leaf-feeders, where the plant-growth has (conjecturally) been driven on past the power of the larvæ. With regard to the precise temperature I have received only a few notes, but they may serve as a general guide.

At the Manse of Shandwick, Orkney, the lowest temperature in shade was 15°·4, the lowest on grass 9°·5; these on January 2nd.

Speaking generally, the frost during the past winter appears to have penetrated in Scotland about the depth of one foot into the earth. At Dalkeith it reached a depth of fifteen inches; and in Perthshire it is stated to have penetrated twenty to twenty-four inches. Mr. Service, writing from Maxwelltown, Dumfries, mentions

that from examination of the Meteorological records it appears that December, 1878, and January and February, 1879, were 9° below the average of the last 115 years: the soil was frozen to a depth of from twelve to twenty-one inches from December 4th till the middle of March; April and May were dry and cold; and the remaining months until the beginning of November were cold and rainy to an unusual —and, as far as known, unprecedented—degree. At Sparham, near Norwich, the lowest temperature of the winter was 3° in the low-lying part of the parish, and 10° on the high ground, on December 25th. At my own station at Isleworth the lowest temperature was 10°·5; the lowest observed on grass was 9°·8 on January 12th. The earth temperatures at one foot deep sunk to between 32° and 33° from December 24th to the 29th, and also from January 12th to February 6th.

An idea being prevalent that "cold kills the grubs," I took the opportunity whilst the great cold lasted of examining the state of all larvæ and pupæ I could find fully exposed to its influence, whether unsheltered, under bark, or in frozen ground, and found that in all cases, even where the earth was frozen so hard that the mass had to be broken up with a hammer, and the larvæ or pupæ were perfectly rigid, that on thawing they did not appear to be in any way injured; and in the case of the larvæ of the Cabbage Weevil (which was the only instance in which any immediate action was to be expected) they continued the operation of making their earth-cases for pupation (as is usual with this grub on disturbance from the gall) as if nothing had happened. Of these observations I give the details under the headings of the respective insects.

In other respects the extreme severity of the winter was favourable to insect preservation, as large numbers were secured from bird attack under the snow or in the frost-bound ground; and also the excessive cold (as shown by the Phenological Report of the Meteorological Society) caused an almost unprecedented mortality amongst the birds; this especially noted amongst the *Turdidæ* and Starlings. The cold and wet spring subsequently retarded the nesting season, and further diminished the ordinary amount by the great numbers of eggs that were addled.

The general returns do not show that any kind of injurious insect has been lessened in amount of appearance by the winter cold, excepting (possibly) the Turnip Fly. This has been little prevalent, but (conjecturally) this is rather owing to failure of the Turnip crops than direct weather influence, as noted in the return: "No Turnips, therefore no Fly."

LIST OF INSECTS RECOMMENDED TO BE OBSERVED.

INJURIOUS TO FIELD AND GARDEN CROPS.

1. Plusia Gamma, Silver Y Moth.
2. Otiorhynchus sulcatus, Black Weevil.
3. Sitones lineatus, Pea Weevil.
4. Agriotes lineatus, Wire-worm Beetle.
5. Tipula oleracea, Crane Fly.
6. Tipula maculosa, Spotted Crane Fly.
7. Anthomyia ceparum, Onion Fly.
8. Tephritis Onopordinis, Celery Fly.
9. Psila Rosæ, Carrot Fly.
10. Aphis rumicis, Bean Aphis, *Collier*.

To Cabbage and Turnips.

11. Pieris Brassicæ, Cabbage Butterfly.
12. Mamestra Brassicæ, Cabbage Moth.
13. Agrotis segetum, Turnip Moth.
14. Phyllotreta undulata, Turnip Fly.
15. Athalia spinarum, Turnip Sawfly.
16. Aphis Rapæ, Turnip Aphis.

To Corn.

17. Cephus pygmæus, Corn Sawfly.
18. Cecidomyia Tritici, Wheat Midge.
19. Chlorops tæniopus, Corn Fly.
20. Aphis granaria, Wheat Aphis.

INJURIOUS TO TIMBER TREES AND FRUIT.

21. Cossus ligniperda, Goat Moth.
22. Zeuzera Æsculi, Leopard Moth.
23. Bombyx neustria, Lackey Moth.
24. Yponomeuta padellus, Small Ermine Moth.
25. Abraxas grossulariata, Magpie Moth.
26. Anthonomus pomorum. Apple Weevil.
27. Eriocampa adumbrata, Pear-tree Slug.
28. Nematus Ribesii, Gooseberry Sawfly.

To Pine Trees.

29. Sirex gigas, Giant Sirex.
30. Retinia turionana, Pine-bud Tortrix.
31. Hylobius abietis, Fir Weevil.
32. Hylurgus piniperda, Pine Beetle.

Observations of any other Insects will also be desirable.

ENTOMOLOGICAL OBSERVATIONS

Taken at _____ *during* _____ 18

By _____

Date.	Number and Name of Object.	Remarks.

Amongst the Lepidoptera some of the injurious kinds have been excessively plentiful in various localities, as also the surface caterpillars. Amongst Coleoptera the weevils of various species have not failed us, neither have the injurious Diptera. The Crane Fly larvæ have fairly ravaged various localities, and the Carrot Fly and Celery Fly have played their part, whilst the Onion Fly has been particularly hurtful in the Isle of Mull. Great injury in many places from the Gooseberry Sawfly, and locally from other species, as also the appearance of *Cynips Kollari*, "like a scourge," at the Glen, Tipperary, and (though Wasps and Honey Bees appear to have been respectively less present or less productive than usual) the great abundance of some species of Humble Bees in the spring, show that the Hymenoptera survived; and on the whole it certainly cannot be said that the cold of last winter has diminished the amount of insect presence in the summer.

Before giving the year's notes it now remains for me to offer, on the part of my colleagues and myself, our hearty thanks to our contributors. In the full conviction that such information cannot fail to be of general service, we feel much indebted to those who allow us to be the means of making it known.

For the coming year it is with great pleasure that I am able to say that, besides many of our original observers, many have come forward, especially in Scotland, amongst the leading foresters and horticulturists, who are well qualified to bestow sound information, and have promised their contributions. Any notes, whether as to amount of insect injury, estimated loss (pecuniarily) from this cause, and, most especially, remedies found of practical use in checking it; also any notes of coincident circumstances, such as of weather influences, or surroundings, or state of the soil, which may increase or diminish insect attack, will all be of service, and gratefully received. Even the shortest notes, possibly thought of little use by the observers themselves, are of value when collated with others; and I should be glad to draw attention to the importance of noting down the observations when they occur: such incidents as the first appearance of the insects, the date at which they are most numerous, and their disappearance, are very apt to slip from the memory if not noted at the time.

With the Report of this year a new observation sheet is forwarded to the contributors, in which many additional insects are recommended for observation, but all in the strict sense of the term injurious, and for convenience of reference are arranged under the heads of the crops which they most commonly attack. The numbering of the list being

necessarily altered, I now give this year's Notes in accordance with those on our new sheet.

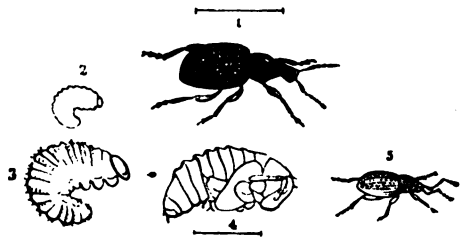
PLUSIA GAMMA.

1. Plusia Gamma. Silver Y Moth. The unusual amount of appearance of this moth has been as remarkable as that of the *Colias Edusa* in 1877; and as we rarely are enabled to trace the march of one of these vast insect appearances forward, I take leave to offer a note, which has been forwarded to me by Mr. Fitch, of Maldon, of the progress of the swarm, which appears to have been composed, at most of the successive points noted, of the moth *Plusia Gamma*, as well as of the Painted Lady butterfly, *Vanessa Cardui*. The swarm appears to have started from the North-west of Africa and travelled in a north-east direction, was observed at Algiers about April 15th to 20th, it reached Valencia, and was spread over Spain, and also present in the Balearic Isles from April 26th to May 3rd, and crossed the Eastern Pyrenees on May 26th and 27th. It next appeared in the South-east of France, Switzerland, and Northern Italy; and on the morning of June 5th thousands of living specimens were found on the snow at the Hospice of St. Gothard. It was then distributed over Germany and Austria at dates of appearance noted as being from June 7th to 16th. Another column crossed the Mediterranean to Sicily, and spread northwards over Italy in June. The more westerly end of the migratory swarm reached Strasburg from June 3rd to 9th; Paris and its environs were apparently not reached till June 15th. The appearance on our South coast was noticed on June 10th; and the moths were subsequently observable throughout the three kingdoms. Mr. Norgate mentions the *Plusia Gamma* as unusually abundant at Sparham, near Norwich, on June 12th and 13th; and it was also noticed on the 13th at Maldon, Essex. Subsequently it occurred in enormous quantities at many localities, the numbers, however, diminishing (as far as appears from the observations sent in) as the points of observation became more northerly. At Exeter, Mr. Parfitt mentions

that he never saw anything to be compared with its numbers: towards the end of September the larvæ literally swarmed on every garden plant, defoliating the plants, as well as riddling the leaves. Mr. Anderson, writing from Chichester, mentions that serious injury was caused by the larvæ of the *Plusia Gamma* to the field Peas, whole fields being stripped of their leaves, and the growth of the pods consequently checked. On August 5th great numbers of the larvæ were collected; two days later they spun up, the moths developing on the 14th, the pupal state thus only lasting a week or ten days. Mr. Anderson also mentions the large flocks of the Common Song Thrush, which congregated in vast numbers, and did good service in clearing the larvæ. At Addington, Bucks, Mr. Matheson observes the moth as much more abundant than usual; and at Isleworth it was noticeable in large numbers (though not in the great swarms mentioned in other localities) about August 10th. The moth was also noticed as exceedingly abundant in the New Forest, Hants, at the end of August and beginning of September; and very numerous likewise at Ashford, Kent. At Maldon, Essex, Mr. Fitch mentions the occurrence of the moth in the greatest profusion about the middle of August, the larvæ also being very numerous, but destroyed in immense numbers by the persistent downpour of rain before they had time to effect serious damage. At Tranmere, near Birkenhead, Cheshire, Mr. Willoughby Gardner gives the appearance of the *Plusia Gamma* as greater than he had seen it in previous years, but not as in such swarms as in many parts of that county in the present season; and at Huddersfield, in Yorkshire, a little farther north, Mr. Mosley mentions it as having been more numerous than usual, but not so much so as it appears to have been in the South. At Maxwelltown, Dumfries, Mr. Robert Service observes "we had no unusual abundance of *Plusia Gamma*, such as was observed elsewhere." With regard to the destructive powers of the larvæ of this moth, where they make good their hold, it may be allowable to give a note (although it is not an English observation) from the statements (quoted in the 'Times' newspaper of November 12th, p. 6, col. 1) made at the previous meeting of the Society for the Promotion of Sugar Beet Industry, at Halle. "Before the appearance of the moth and caterpillar the Sugar Beet crops in Saxony were in excellent condition, and would in ordinary circumstances have yielded a harvest of from nine to ten tons per acre; the actual yield where the caterpillars had been was only three tons."

2. Otiorhynchus (sp. **sulcatus** and **picipes**). The *Otiorhynchus picipes* appears to have been present in unusual numbers during the

two past seasons in the South-west of England. Mr. John Thomas, of Ridgeovean, Gulval, Cornwall, in a communication forwarded through Mr. D'Urban, of Exeter, notes a severe attack of these



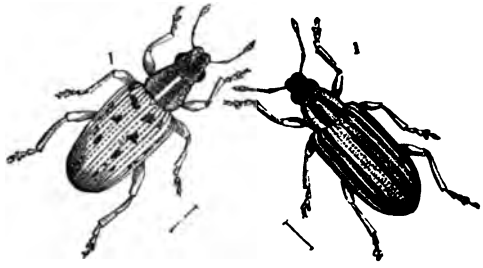
OTIORHYNCHUS (sp. SULCATUS and PICIPES).

Weevils, in 1878, in his Raspberry gardens, which extend over two acres of land. The whole of the Canes were stripped of their shoots, and the crop consequently sacrificed, causing a loss of upwards of £100. In the present year, 1879, Mr. Thomas, on examination of his Raspberry bushes at night, found the brown Weevils gnawing through the succulent stems of the blossom-shoots, some consequently withering, some being cut right off. At the approach of daylight the Weevils went down to the ground and hid themselves just below the surface, or under the stones. Hand-picking, strewing the ground with lime, and daubing the feet of the Canes with coal-tar, were tried as remedies, but found to be either insufficient or useless. Mr. Thomas had then a number of wooden trays constructed, the inside of which was smeared all over with tar. The Raspberries are planted in clumps and bent into arches: after dark one man held a tray beneath an arch, another carrying a lantern gave the bush a smart tap, and the Weevils fell into the tray; the tar held them prisoners for a time; and after the tray had been placed under a bush or two the Weevils collected were killed by pouring boiling water over them. It was found necessary that the water should be quite boiling to effect this thoroughly. Mr. Thomas had thirty or forty persons at this work on his grounds, and each bush was treated three times in this way. An immense number of Weevils were caught, estimated at hundreds of thousands; and it was hoped by continuing this plan to avoid much future loss. Raspberry grounds at Pleming, Polgoon, and Ponjou, were mentioned as similarly attacked; and in 1878 Raspberry plots in the large fruit gardens in Gulval and in part of Madron (also in Cornwall) were almost totally destroyed, at a loss of many hundred pounds. Mr. D'Urban mentions the presence of a considerable number of the

Otiorhynchus picipes on his Raspberries at Exeter; but by the use of a sweeping-net after dark, during the month of June, he prevented any but slight injury from the attack. Mr. Clapham observes relatively to *Otiorhynchus sulcatus*, which had been exceedingly numerous in his garden at Scarborough, that on taking up his Primulas (800 to 900 in number) very few of the Weevil grubs were found, and only a limited number of the perfect Weevils were observed during the season. This he considers may be partly attributable to the seedlings being planted in fresh earth, partly to the excessive rainfall, but mainly he believed to the presence of Hedgehogs, whose services had been of much use in clearing off the plague of Slugs, and he considers had also destroyed the Weevils. Mr. Rolfe notes the *O. sulcatus* being as destructive as usual to Primulas, &c., at Welbeck, and especially to some *P. Japonica*, from which larvæ were picked in great numbers. In the same frame were about a dozen other plants in pots, of which the balls of earth were frozen into solid masses. After being in this state for about eight weeks they were placed, about the beginning of March, in a Vinery just starting, and on the 15th two Beetles appeared, and others successively, until by the 29th a hundred and twenty-six had made their appearance, the greater part of the number coming out on the 20th, when sixty were captured. They crawled up leaving a little hole in the soil (each Beetle with a little of the earth, that had adhered to it in forcing its way, still on the wing-cases), and in some instances so recently developed as to be still soft. After crawling out of the soil they remained quiet amongst the young leaf-stalks just above the surface, and some on the inner rim of the pots, conjecturally, waiting for darkness to start on their errands of destruction. From observations made during February of the present year on larvæ of *Otiorhynchus sulcatus*, which had been left in earth in flower-pots in my garden at Isleworth exposed to cold, reading as low as 11°·8, they appeared, with scarcely any exception, entirely uninjured by the severe weather. The balls of earth were frozen hard, and the larvæ stiff and motionless, but they gradually regained flexibility, and for the most part (and the few exceptions not evidently attributable to cold) appeared in complete health in all respects. Soot and sulphur are mentioned by Mr. W. R. Scowcroft as having been found of some service for application to garden plants at Lathom, near Ormskirk, Lancashire, but not as being satisfactory, from the frequent renewal needed with regard to the soot, and the great quantity of sulphur requisite for thorough effect.

3. Sitones lineatus. Pea Weevil. These are mentioned by Mr. Fitch as very abundant in spring on the Peas, and very destructive

to the plant. The perfect Beetles which had survived the winter were to be found till the end of May. The autumn swarms, which are usually so abundant on the Red Clover that it is impossible to avoid noticing them, were this year totally absent. At Maxwelltown, also,

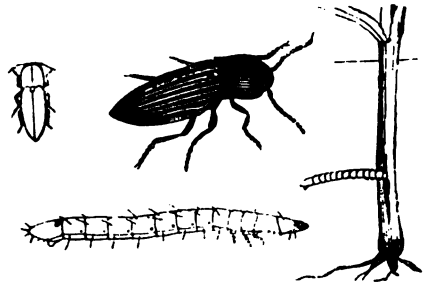


SITONES (left, S. CRINITUS; right, S. LINEATUS).

Mr. Service mentions numerous complaints of this Weevil; otherwise it has been little noticed this year. At Sedbury, West Gloucestershire, where the Weevils are commonly very plentiful, they are mentioned as less numerous than in ordinary years, and also as not nearly so abundant as usual at Kingsnorth, in Kent. At Isleworth I saved the Peas in my garden from all attack by having them sown in coal ashes, which had been well saturated with the mixture known as soluble phenyle, used diluted in the proportion of about two table-spoonfuls of fluid to two gallons of water, the ashes being covered up and left some days to get thoroughly imbued with the smell. Observations are greatly needed as to where these Weevils lay their eggs, and what the larvæ feed on. The females lay freely in captivity in May, depositing the eggs (apparently at hap-hazard) on any accessible surface, whether leaves, earth, or the glass of the cage. None of these eggs, however (though presumably fertilised, and treated with care), have ever hatched in my own experience.

4. Agriotes lineatus (and allied spp.). Wireworm Beetle. At Dalkeith, Mr. Malcolm Dunn mentions that Wireworms have been much less seen or destructive than usual, and in turning up soil infested by them they have been observed at a greater depth than usual. Mr. Fitch observes that he never remembers these larvæ in such numbers amongst the Corn so late as in this season, but though generally common near Maldon no specially injurious attack occurred. In an eleven-acre field of Mangolds the Wireworms were found commonly at every hoeing, and in such quantities as to attract the attention of the labourers employed when the crop was pulled in the

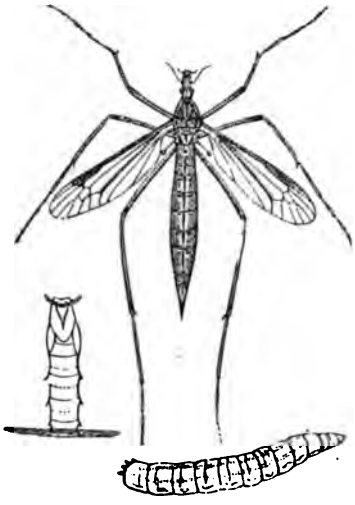
first week of November. The safety of the roots appears to have been partly attributable to the enormous quantity of "black grass," *Alopecurus agrestis*, which, being unconquerable from the wet weather, to a certain extent attracted the Wireworm from the roots. After the



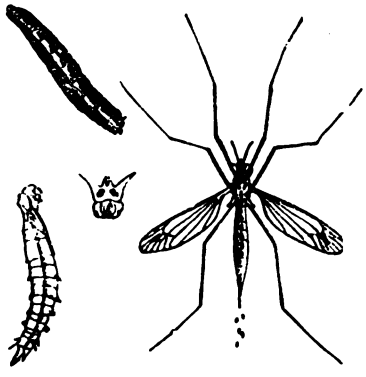
AGRIOTES LINEATUS.

Mangolds were pulled Peewits and Rooks were busy on the field for a week, probably doing good service in clearing larvæ. At Knebworth, Herts, Mr. Benjamin Brown mentions the larvæ of *Agriotes obscurus* as doing much damage on some light-land farms to the young Barley after fallow, and where the land was in bad condition; but where the Barley succeeded a good crop of roots, fed on the land by sheep, or where there was plenty of manure in the soil, the plants grew too vigorously to receive much injury. On heavy clay land the soil was so close that the Wireworm could hardly exist. Mr. Silvester, writing from the neighbourhood of St. Albans, also notices that Wireworm has not been as destructive as usual in the fields. Mr. Matheson mentions that at Addington, Bucks, Potatoes that were planted on ground trenched, and the turf buried during the severe weather of last winter, have suffered very much. He notes the Wireworm being, as a matter of course, troublesome on newly broken-up ground, and that in breaking up pasture land, breast ploughing, and burning the turf, would be a good measure for destruction of the insects. At Tangley, Guildford, Mr. Newton Smith notes that a piece of Wheat was being ravaged in May by larvæ of *Agriotes obscurus*, but being on very loamy soil and exposed to excessive rain the frequent application of Crosskill's roller saved it (? by preventing the passage of the Wireworms from plant to plant). Mr. Hart records no damage of any importance being done this year by Wireworm in the neighbourhood of Ashford, Kent. At Tranmere, near Birkenhead, the Wireworm was moderately plentiful, but not very injurious; and at Huddersfield, Yorkshire, Mr. Mosley mentions a field dressed with excessively stimulating

animal manure being badly infested with Wireworm. This agrees with the observations of Bouché, quoted in Curtis's 'Farm Insects,' p. 159, of the Wireworm sometimes living in multitudes in dung. Mr. D. Sym Scott, writing from Ballinacourte, Tipperary,—after mentioning that the most destructive ravages of the Wireworm in the locality appeared to be more than usually confined to sheltered gardens and fields,—gives some useful observations as to relative amount of Wireworm attack, under different methods of treatment, on a piece of ground which, for fourteen years prior to 1878, had been lying out in grass, and last year was in Oats. Of this he remarks, only half the field was ploughed last autumn; the other half, being required for hand-feeding sheep, was not turned over until just before seed sowing; on the latter half the Wireworm was most destructive. Over a portion of this unploughed stubble, timber was carted during the winter months from a neighbouring plantation, and on the part that was carted over there was no appearance of the Wireworm. From this Mr. Scott draws the lesson, "Plough early, and use a land presser." Rape cake has been mentioned to me as a useful preventive for Wireworm, but I have no detail of experiment.



TIPULA OLERACEA.



TIPULA MACULOSA.

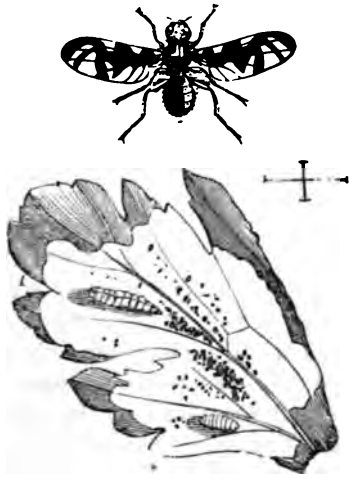
5 & 6. Tipula oleracea and **Tipula maculosa.** Crane Fly; Leather Jackets (larvæ). The larvæ of these Flies, often known as Wireworm in the South of Scotland, appear to have been numerous and injurious generally this year, excepting at the most northerly

point of observation. Mr. McDonald, writing from Kirkwall, Orkney, mentions the grub of the Crane Fly being little noticed during spring in the neighbourhood. He observes that when the months of May and June are cold and wet this grub is often very destructive to the field crops, but less so on light land and in warm weather, conjecturally from its more rapid development. Deep digging in winter and keeping the ground well stirred are found to be good preventives, and also the application of seaweed as a manure, before the ground is ploughed, this insect appearing to have a great dislike to anything of a salt nature. At Dalkeith the Crane Fly was comparatively scarce. Mr. Service observes that at those spots in the neighbourhood of Maxwelltown, Dumfries, where the Crane Fly was so destructive in 1878, it was scarcely noticeable this season, whilst in others in the same locality it was present to a most injurious extent. According to report grub-worms had been counted at the rate of twelve, and even up to twenty-four, per square foot; and this insect is considered by Mr. Service as without doubt the worst pest of the district. At Scotswood-on-Tyne, in Northumberland, also, these grubs were very injurious. Mr. Herbert Grace mentions that in some places the Corn was entirely destroyed by them; and in July and August the "Daddies" swarmed in the long grass, Wherever the grub occurred it was amongst Corn grown after "lea," and it was in the greatest numbers on heavy land. At Tranmere, Cheshire, Mr. Willoughby Gardner mentions that he never remembers the Crane Flies occurring in such numbers before: the perfect insects were most numerous the second week in August, when the noise they made buzzing about in swarms was distinctly audible in the fields. Mr. W. R. Scowcroft, writing from Lathom, Ormskirk, Lancashire, a district noted for its Potato crops, mentions that the *Tipulæ* larvæ attacked the Potatoes severely, eating through the stems. The larvæ were in such numbers that on one farm women and lads were employed to collect the grub, at so much a quart. The country round Ormskirk is flat, and the ground having been several times flooded this season has probably made it attractive to this damp-loving insect. The unusual quantity of *Tipulæ* round Brecon is mentioned by Mrs. Garnons Williams, of Abercamlais, as the great insect feature of the year. The larvæ of *Tipula maculosa*—small, light-coloured, and softer, as compared with the Leather Jackets, the larvæ of *Tipula oleracea*—are noted by Mr. Fitch as very destructive, in a nine-acre field of his at Maldon, to Wheat after Red Clover. In April he had the Charlock (*Sinapis arvensis*) pulled, and the soil being wet and tenacious much was adherent to the fibrous roots, and the quantities of small *Tipulæ* larvæ exposed were enormous. In this

miserable season no remedy appeared applicable, and the amount of plant was seriously diminished. With regard to *Tipula oleracea*, Mr. Fitch mentions the larvæ have been very abundant in his meadows and Lucerne leys this year; and notwithstanding the great numbers daily cleared off by the Starlings have been destructive to some extent. The perfect Crane Flies were first noticed on September 5th, and became generally common from the 10th and 12th. As this is the first time in which this insect, so disastrously destructive to grass land, is included in our Report, Mr. Fitch records an instance of a remarkably bad attack occurring in a fair sized garden, at Maldon, in the beginning of April, 1876. The lawn was completely bared, and the larvæ in such numbers that there was no difficulty in collecting them in barrowfuls; fifty-seven larvæ were counted at one Daisy root. Hand-picking was useless, and a quantity of Ducks were turned in, the soil being stirred into shallow furrows from time to time to allow them to reach their prey. Eventually the ravages ceased almost as suddenly as they had begun, but not until every piece of grass in the garden was bared, as if it had been cut with a turfing iron and left to die on the spot. Grass seeds were sown in the late spring, and their growth encouraged by a judicious use of nitrate of soda and dissolved bone manure. This soon restored the turf, and the *Tipula oleracea* has hardly been noticeable since. Looking at the partiality of *Tipulæ* larvæ for damp ground, and that of the perfect Crane Flies for rough neglected herbage, and their dislike to saline presence, it seems as if something might easily be done by draining, removal of lurking places, and dressing with chemical manures, at least to diminish this trouble; and the fondness of birds for the grubs shows a direct method of destruction, whether by general encouragement of Insectivora in the fields, or the more limited application available in the garden.

7. Anthomyia ceparum. Onion Maggot. Onion Mack (Scottice). Mr. McDonald mentions that at Balfour Castle, Kirkwall, Orkney, the Onion Maggot showed itself in the greatest numbers where Cow manure had lain for a considerable time previously to it being dug in; all the plants near to or beneath the position of the heaps were cleared off about July 1st. In the Isle of Mull the *Anthomyia ceparum* is mentioned by Mr. Grierson as exceedingly plentiful, fully two-thirds of the crop being destroyed. Mr. D. Melville, writing from the Gardens, Dunrobin Castle, Sutherland, notes that the Onion Fly has not been troublesome there this year. He says:—"I find the best preventive in our light soil is to manure well with

well-made manure, principally Cow manure. We work the ground deeply, and trench if need be. After lying exposed to the frost for some time, the ground is pulverised (with a steel fork), on the surface, without turning up the manure, then trodden down well previous to sowing, which we do as early as possible in March, providing the ground is in good condition. We sow in lines a foot apart. After covering in the seed we pass a heavy iron roller a few times over the ground to firm it well. We sow thinly, so that we seldom require to thin the plants. In this way we never fail to have excellent crops of Onions, although the garden has been very subject to attacks from Onion Fly; and there are many gardens in the neighbourhood where the Fly has all its own way with the Onion crops." At Maxwelltown Dumfries, Mr. R. Service mentions the Onion Fly being as destructive as usual; and observes that it is worse on the little plots of the cottagers than in large gardens or nurseries, this (conjecturally) owing to the difference of cultivation. Possibly, also, though this may be included under the head of cultivation, the amount or nature of manure applied in cottage gardening may be insufficient or unsuitable. At Bury, Lancashire; Addington, Bucks; Isleworth, and Maldon, the Onion Fly was not noticed. At Tangley, Guildford, the Onions were remarkably good on the same plot of ground used last year; a liberal supply of wood ashes and ashes of garden refuse was given as manure.



TEPHRITIS ONOPORDINIS.

8. Tephritis Onopordinis. Celery Fly. This is mentioned as very prevalent at Addington, Bucks; Ashford, Kent; and Maldon;

but not as causing much damage. Mr. Dobson mentions the grubs of the Celery fly as doing much damage at New Malden, Surrey, about September 28th. On October 15th he notices them as still extremely numerous, and much more so than last year, for then some plots escaped; this season the celery in the same ground has been wholly destroyed. At Sedbury, West Gloucestershire, it is mentioned as in greater quantity than it had ever been seen before; and in various localities at Isleworth the crop was much injured; but on November 7th I noticed a patch of Celery that was remarkably healthy and little injured by the Fly in a garden on Hounslow Heath, not in the immediate vicinity of other Celery plants; this was on peat soil, shown in section to be about a foot and a half thick, over-lying three feet of gravel; possibly the gravel went much deeper, but the section was only about five feet deep. The commonly suggested remedy of pinching the grub in the blistered leaf, or removing the infested piece, does not seem to answer excepting when the attack is slight; and as the maggot is sheltered inside the leaf the only preventive appears to be making the leaves distasteful for oviposition to the Flies, or poisonous to the newly-hatched maggots. Mr. Herbert Grace mentions that he has found a solution of washing-soda, liberally applied to the plants, very effectual in destroying these pests.

Psila Rosæ.

9. Psila Rosæ. Carrot Fly. The Worm (Scottice). With regard to this Fly Mr. Donald mentions that at Balfour Castle, Kirkwall, the ground is of a strong clayey nature, and many experiments have been tried in previous years to grow good Carrots, but without effect. Last winter, however, instead of digging in manure about the same quantity of peat and sand was dug in, and before sowing a good watering with gas-water was given, and the result of the treatment has been a beautiful crop of clean Carrots. At the Gardens, Dunrobin Castle, Sutherland, Mr. Melville mentions the Carrot Fly as being always troublesome. In most years a good yield is secured by carefully trenching, and keeping the manure about a foot or fifteen inches from the surface. This year, however, the Carrots were grown principally

on a piece of ground which, though thus treated, was where Strawberries had been grown the previous year, and on this piece the attack of the Fly was worse than it had been known for several seasons. A few rows at one side were sown on a piece of ground which did not require trenching, this having been done the previous year; these were comparatively free from the attack of Fly or Grub. A few rows in another part of the garden, which had been trenched and prepared for Strawberry planting, were comparatively free from Grub. Mr. Melville considers that in gardens where Carrot Fly abounds Carrots should not be sown where Strawberry plantations have been recently dug, or trenched down; and that if Carrots require thinning this should be done when they are an inch or two high, as if thinned when from this size to six or eight inches high the Fly seems to attack them more readily; he mentions wet weather as the best time for thinning, and that his practice is to use the best seed, sow thinly, and never thin at all till the Carrots are beyond the reach of the Fly, and fit for kitchen use. Mr. Webster, writing from the Gardens, Gordon Castle, Fochabers, Banffshire, mentions that this year the Carrot crop proved an entire failure; and his report is of considerable interest, as in 1878 there was not a single root infested in the Carrot crop grown on the same piece of ground, and treated in precisely the same manner. Some of the ground was trenched, other portions sown without trenching, and all otherwise treated alike, viz., by covering over the seed in the drills with fully half an inch thick of sifted wood ashes. This season not one of the different plots escaped. The Carrots were all attacked about 2½ to 3½ inches below the surface, showing that the larvæ did not like the caustic contained in the ashes, the upper part of the Carrots remaining perfectly sound. In this case it appears to me open to suggestion that the attack might be from larvæ remaining in the ground, and that the preservation of the root for as deep down as the effect of the wood ashes reached points to the possibility of doing good by waterings of an alkaline nature, such as might be distasteful to the Grub, and contain constituents of the root. Analysis shows thirty-two parts in the hundred of potash and fourteen of soda in the constituents of the Carrot root, and the application of chemical manure, that would both press forward the Carrot growth and be deterrent to the Grub, in a form that would take itself well to the bottom of the root, might have an excellent effect. At Torloisk, in the Isle of Mull, Mr. Grierson mentions the Fly as being very destructive this season. The Carrot Fly appeared as usual in July at Dalkeith, and its ravages were about the usual amount. Mr. Service notes the garden crops of Carrots at

Maxwelltown as more severely attacked by the *Psila Rosæ* than he remembers in previous years, to such a degree that he hardly knew of a single professional gardener who saved a crop; but at the same time he notes it as a curious circumstance that the field crops were scarcely touched; it is considered locally that in wet seasons the Carrots escape the Fly.

10. Aphis Rumicis. Bean Aphis; Collier.. Black Fly (Scottice). No notes.

PIERIS BRASSICÆ.

11. Pieris Brassicæ. Large Cabbage Butterfly. The amount of appearance of the Pieridæ has varied much in different localities. Mr. Malcolm Dunn mentions that at Dalkeith the Large Garden White Butterfly (*Pieris Brassicæ*) appeared in rather formidable numbers after the fine weather set in. The consequence was a severe attack of its caterpillar, especially in cottage gardens surrounded by weedy hedges, and other harbours for insects, where the common Cabbage, Savoys, &c., were completely riddled by the vermin, and rendered totally unfit for human food. Mr. Dunn considers the best remedy is hand-picking the caterpillars, but this is tedious; and he mentions that a sprinkling of fine salt is very serviceable, carefully applied by turning up every leaf, so that a small portion of the salt shall touch every grub. The application of finely-powdered lime in a caustic state, or even caustic soot, will get rid of the grubs, but both are objectionable with regard to the after use of the vegetables. At Marchmont Dunse Mr. P. Loney notices the almost total absence both of the butterflies and the larvæ. At Scotswood-on-Tyne, Mr. Grace mentions *Pieris Brassicæ* and *P. rapæ* being so scarce he could almost count the specimens, and that with repeated search he did not find one caterpillar. At Huddersfield, Knebworth, Chichester, and Maldon, few were observable; and Mr. Norgate mentions *P. Brassicæ* not being

as plentiful as usual near Norwich. At Isleworth *P. rapæ* were moderately plentiful. Mr. Rolfe notices *P. Brassicæ* as very scarce at Kew in the spring; and the autumnal brood also as few in number, but more numerous. The first appearance is noted on June 8th. *P. rapæ* appeared on May 4th; *P. napi* was not observed. Mr. Rolfe mentions having found pupæ of the Pieridæ attached to walls, and frozen so hard that they could be snapped like sticks, but of which those kept for observation appeared perfectly healthy on being thawed, and produced perfect imagos in due time. On the other hand, great numbers of the Large Cabbage Butterfly were observed in the Isle of Mull by Mr. Grierson, but few caterpillars. At Aber Camlais, Brecon, they appeared early in the year, and the butterflies were plentiful, but little injury done by caterpillars. At Sedbury Park, West Gloucestershire, the caterpillars were very numerous; and they are also mentioned by Mr. Hart as doing great harm to the Cabbage in gardens at Kingsnorth, Ashford, Kent, so that on examining a small plot of Cabbages in his own garden scarcely a plant in it was without some amount of eggs. Such pupæ of the Pieridæ as I had opportunity of examining during the continuance of the severe cold of the winter of 1878–79, when the minimum reading of the thermometer ranged between 10° and 30° on twenty-five nights in January, appeared perfectly uninjured by it: *P. napi* was only temporarily stiffened, and *P. rapæ* developed the imago on April 4th from specimens brought in after February 7th, this appearance being exactly a month before the first specimen noticed of *P. rapæ* out of doors. The parasites in a pupa of *P. napi* were also temporarily stiffened, but otherwise uninjured.

MAMESTRA BRASSICÆ.

12. Mamestra Brassicæ. Cabbage Moth. This moth is mentioned by Mr. F. Norgate as abundant at Sparham, near Norwich, on July 12th; and the caterpillars are noticed by Mr. Dobson as being unusually plentiful at New Malden, Surrey, at the beginning of October; otherwise it appears not to have been as numerous as usual. At Bury, Lancashire, it is noted by Mr. Kaye as less plentiful than

usual; and also at Tangley, Guildford. Mr. R. A. Rolfe mentions that the caterpillars of this moth did some amount of damage to the autumn Cabbages near Kew; in some plots the hearts were much riddled, and hand-picking resorted to with partial success.

13. Agrotis segetum. Turnip Moth. We have no notes of appearance of *Agrotis segetum* taken by itself, but the surface caterpillars appear to have been excessively numerous at different localities. Mr. Tait, of Inverurie, Aberdeenshire, mentions Noctuæ as being more than usually plentiful up to the end of July; after that they were scarce, and several of the autumn species did not occur at all. Mr. Tait mentions that snow lay on the ground in the district from early in December until April; and he attributes the preservation of the early summer Lepidoptera to this protection, and the small quantity of autumn appearance to destruction in their early stages by cold wet weather after thawing of the snow. He notes the autumn larvæ as very abundant. Mr. Kaye mentions that at Bury, Lancashire, the surface caterpillars have been very numerous and destructive; and at Tranmere, Cheshire, Mr. Willoughby Gardner observes that the larvæ of various common Noctuæ, as *Agrotis*, *Mamestra*, and others, have been a regular pest in gardens this summer, eating up all the green leaves, and even turning as a last resource to Ivy and and Ferns. Mr. Fitch also mentions a similar visitation in a garden at Islington, where the numbers of larvæ were enormous. These larvæ appear to bear low temperatures perfectly well, for a few specimens of surface caterpillar, which I found in my garden at Isleworth, were quite uninjured by frost penetrating for many days (at readings of between 32° and 33°) a foot deep into the ground; and many specimens were brought me in from the neighbourhood also perfectly uninjured.

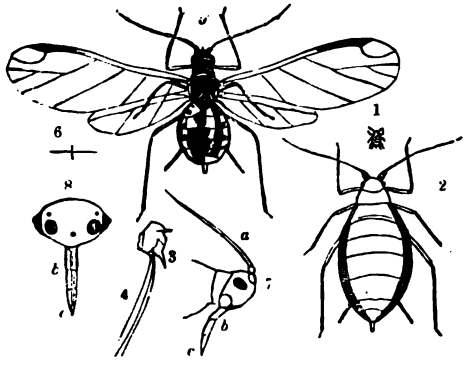
14. Phyllotreta undulata, and other species. Turnip Fly. Flea Beetle. Mr. McDonald mentions the Fly as being usually rather destructive at Kirkwall amongst the Turnips in a mild summer; if the season be wet and cold it is hardly noticeable. Dusting the leaves with wood ashes whilst the dew is still on is found to be a good remedy. At Dunrobin, Sutherland, Mr. Melville notices that the Turnip Fly has not done much mischief, probably owing to the wet weather. Many fields of Turnips were almost a total failure, but the season appears to have been too wet for the Fly to have much to do with it. In Isle of Mull the Fly is mentioned by Mr. Grierson as not being as numerous as in previous years; and at Inverurie, Aberdeen,

Mr. Tait mentions it also as not being especially abundant; and as the Turnips were sown late and grew rapidly little damage was done. Mr. P. Loney, writing from Marchmont, Dunse, Berwickshire, notices the Turnip Flea as extremely numerous. Owing to the cold state of the soil the plants in many cases never got beyond the Cotyledons, when they were eaten over. The rainfall of June amounted to 5·30 ins., but had no effect on the Fly. The rainfall of July gave a total of 6·40 ins., leaving the land in such a state it was impossible to work the soil, consequently many acres could not be sown. Mr. Robert Service mentions the Turnip Fly as extremely prevalent near Kirkcudbright, where it entailed the loss of a large quantity of seed. In Wigtonshire it committed unusual ravages, and a great breadth of the crop required to be resown. At Maxwelltown, Dumfries, it was noticed on June 14th at one or two farms only, but not to any great extent. At Dalkeith Mr. Malcolm Dunn mentions there was a slight appearance of Turnip Fly accompanying three or four days' fine weather about June 20th, but this was not nearly to the same extent that is usual in the district, in seasons more favourable to the beetle, so that the damage done was comparatively trifling. At Scotswood-on-Tyne Mr. Herbert Grace mentions the Fly as not doing much harm, excepting on badly-farmed lands, where the Turnips had to be resown on account of its ravages; and he draws attention to previous observations in the Reports of the spread of the Fly from Charlock. At Knebworth, Hants, and Addington, Bucks, the Fly was scarce, or not troublesome, apparently from the wet and cold weather; and at Sedbury Park, West Gloucestershire, it was not as numerous as in some previous years. In the neighbourhood of Exeter it is mentioned by Mr. D'Urban as being very numerous in gardens in July, and that as far as his observations went the commonest species was *Phyllotreta nemorum*. At Tangley, near Guildford, Mr. Newton Smith notes (as showing that rain alone cannot always be depended on to clear the Fly) that Turnips which germinated about the middle of May were badly attacked before the application of soot. He also draws attention to the importance of such liberal feeding to the plant as may induce a vigorous growth after setting out that will baffle the Fly. This point, also, Mr. Silvester previously drew attention to and illustrated from the various amount of injury to his crops by Fly, according to their luxuriance and healthiness of growth. This year Mr. Silvester mentions his root crops as exceptionally free from Fly, though suffering from the bad weather. From Maldon Mr. Fitch returns, "no Turnips, therefore no Fly"; and from Kingsnorth, Kent, Mr. Hart similarly reports, "Scarce, the Turnip crop generally being a failure

with us this year." At Kew the Fly is mentioned by Mr. Rolfe as entirely absent or unnoticed; and I only observed it in small numbers in the adjacent district of Isleworth. I am informed by Mr. J. Chambers, Hounslow, that the application of hops fresh from the breweries is found very useful round Hounslow in keeping down Fly on the Cabbage crops. The reader will notice that Fly has been little noticed in the returns, excepting in the four southern counties of Scotland, and in some degree in the adjacent county of Northumberland.

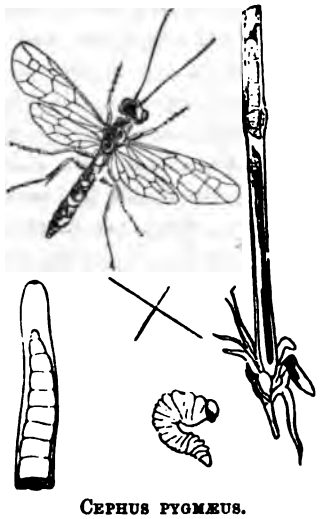
ATHALIA SPINARUM.

15. Athalia spinarum. Turnip Sawfly. Nigger. Entirely unnoticed in Turnip crops.



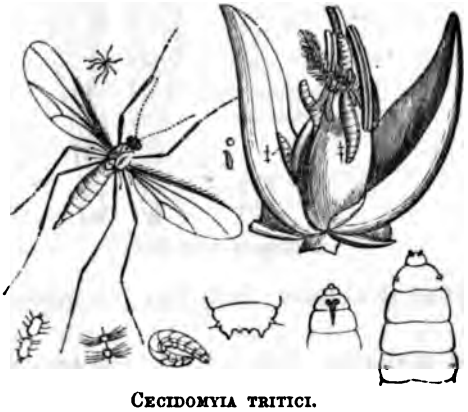
APHIS RAPÆ.

16. Aphis Rapæ. Turnip Aphis. Blue Fly (Scottice). No notes.



CEPHUS PYGMÆUS.

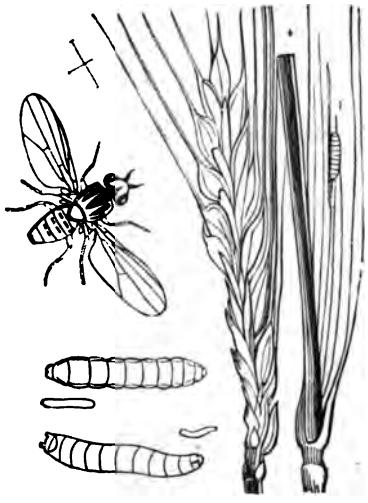
17. Cephus pygmæus. Corn Sawfly. No notes.



CECIDOMYIA TRITICI.

18. Cecidomyia tritici. Wheat Midge. Red Maggot. Mr. Brown, of Knebworth, mentions that the Red Maggot was abundant in all the earlier Wheat fields, and did much damage, but little to the later crop; Wheat-ears did not make their appearance until about June 29th, instead of June 12th, which may account for the date of the attack. The Rev. Arthur S. Ormerod, writing from Halvergate Vicarage, in the East of Norfolk, similarly observes that in a little patch of Wheat, a quarter of an acre, sown in the autumn, suffered

much from the Wheat Midge; whilst another quarter of an acre close alongside, which, owing to wet and frost, was not sown till spring, was not injured by it. Mr. Fitch notices that on June 27th, at Maldon, the Wheat Midge was especially abundant, whilst there were as yet no Wheat-ears in which it could lay its eggs; no damage took place from the ravages of the larvæ. Mr. Edward Parfitt mentions the *Cecidomyia tritici* as little observable this season near Exeter; and the Wheats round Kingsnorth, Kent, are mentioned also as very free this year from the Red Maggot. At Ballinacourte, Tipperary, it is mentioned as plentiful by Mr. Sym Scott.



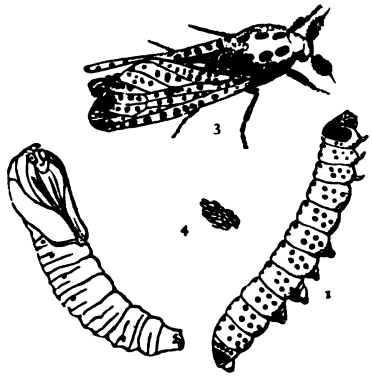
CHLOROPS TÆNIOPUS.

19. Chlorops tæniopus. Corn Fly. No notes.

20. Aphis granaria. Wheat Aphis. Mr. Leather, writing from Delamere Lodge, near Northwich, Cheshire, gives a detailed account of an extremely bad attack of this Aphis on 110 acres of Wheat. He mentions the Aphides as first appearing in the early part of August, and shortly after they were not as observable; but about September 8th they were again noticeable in as great, or greater, numbers than before. The ears they had previously attacked had become perfectly white, as if blasted; and at the date of the communication (September 16th) every green head in the field appeared full of them. It was estimated that what ought to have given four to five good quarters of Wheat would not yield more than ten to twelve bushels per acre, and

that of very inferior quality. The Wheat was March-sown, part after Turnips, part on a Clover stubble. The land is naturally poor and light, but has been marled and heavily caked. The application to each acre would average 6 cwt. of cake, two-thirds linseed and one-third decorticated cotton-cake, consumed by sheep on the ground. The weather during the season is noted as having been the wettest on record, and the crop as six weeks later than in average seasons. Mr. Mosley also mentions that the Wheat Aphis literally swarmed at Thornhill, near Dewsbury, Yorkshire, both on Wheat and Barley, doing much injury.

21. Cossus Ligniperda. Goat Moth. Ogger, or Auger, Worm (Scottice). No notes of remedies beyond the well-known method of extracting the larvæ with a wire.

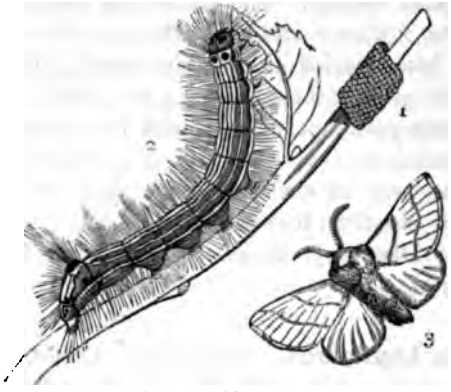


ZEUZERA ÆSCULI.

22. Zeuzera Æsculi. Leopard Moth. More common than usual at Maldon. During the severe weather of the winter a few specimens of larvæ were brought to me in small boughs, or rather in thick twigs, at Isleworth, quite uninjured by cold.

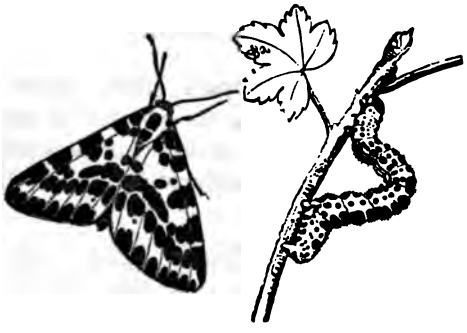
23. Bombyx Neustria. Lackey Moth. No observations, excepting of its complete absence at Maldon, where in the previous year it had appeared in such enormous quantities that Mr. Fitch had his Apple trees hand-picked, and the larvæ collected in pails and scalded.

24. Yponomeuta Padellus. Small Ermine Moth. The larvæ injurious on Apple trees, at Chichester, about July 4th.



BOMBYX NEUSTRIA.

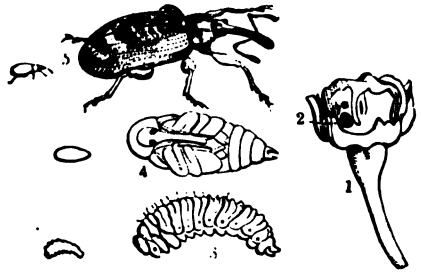
YPONOMEUTA PADELLUS.



ABRAXAS GROSSULARIATA.

25. Abraxas Grossulariata. Magpie Moth. This appears to have been unusually plentiful, as well as the Gooseberry Sawfly. Mr. McDonald mentions the caterpillars attacking the Red and

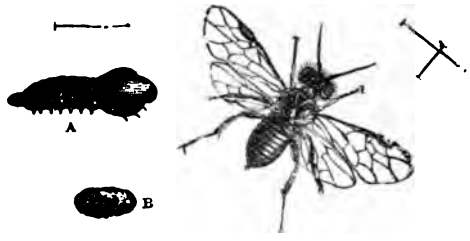
White Currants, in Orkney; and at Dunrobin Castle the Gooseberry caterpillar is also mentioned as troublesome. At Scotswood-on-Tyne, in Northumberland, Mr. Grace mentions that by far the most noticeable insect occurrence of the season was the large amount of *Abraxas Grossulariata*, though the damage done by the larvæ was small. During this season he observes the moths have been so plentiful that fifty specimens might be captured in half an hour; and this abundance is the more remarkable as for eight previous years not a single specimen had been taken by Mr. Grace whilst collecting Lepidoptera. At Tranmere, Cheshire, it is mentioned as rather more scarce than usual; and near Ashford, Kent, it was noticed on the Blackthorn, but not in great numbers anywhere. Mr. Norgate, writing from Sparham, Norwich, mentions the larvæ as more plentiful than usual on the Blackthorn; and they are also mentioned by Mr. Fitch as in extraordinary abundance on Blackthorn hedges near Maldon. At Addington, Bucks, Mr. Matheson reports it as doing an immense amount of damage where not checked, and recommends careful attention to the bushes, and drawing the sprays through the hand as soon as ever the caterpillars appear, so as to remove them before they have time to spread over the tree. At Sedbury, West Gloucestershire, this insect is also mentioned as hurtful; and at Exeter Mr. D'Urban observes the larvæ were first noticed on May 18th, feeding on Red Currants trained on a wall, and a few on Black Currant bushes; at the end of June they were numerous on Blackthorn in hedges; and at the end of August the moths appeared in unusually great numbers on the hedges near Dawlish, and generally in the neighbourhood.



ANTHONOMUS POMORUM.

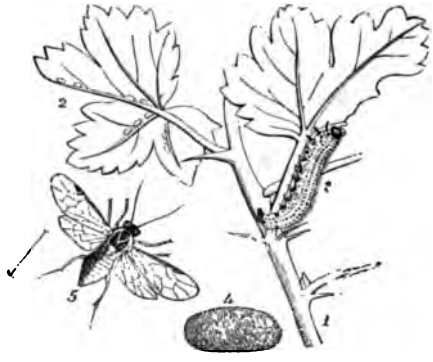
26. Anthonomus Pomorum. Apple Weevil. Of this we have only a note from Mr. Hart, mentioning it being less abundant than usual at Kingsnorth, near Ashford, Kent.

27. Eriocampa adumbrata. Pear Tree Slug Worm. Mr. Malcolm Dunn mentions that the Pear Tree Slug, which last year did much damage in the district round Dalkeith, has been scarcely noticed this season, and that the easily applied remedies of a dusting of



ERIOCAMPA ADUMBRATA.

caustic lime, or a heavy syringing of the trees with strong soapsuds, are generally very effective in getting rid of this pest. Mr. R. Service notes that the insect sometimes appears in destructive abundance near Maxwelltown, making an unsightly mess of Pear, Cherry, and Plum trees, in the nurseries, but that it appears of very uncertain occurrence, in some years being totally absent. A very few of the larvæ were observed on Espalier Pears at Maldon this year, but not until the autumn. Mr. Fitch mentions that in previous years they have usually been exceedingly abundant in his garden, the foliage of the Pear and Cherry trees often assuming quite a scorched appearance from the ravages of the larvæ.



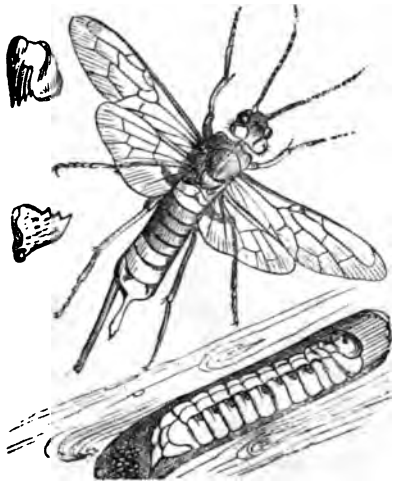
NEMATUS RIBESII.

28. Nematus Ribesii. Gooseberry Sawfly. This appears to have been unusually prevalent and injurious at all the points from

which we have notes, excepting at Inverurie, near Aberdeen, where Mr. Tait mentions that on the whole there was less injury than usual. With regard to remedies for this insect I am favoured with a note from Mr. McCorquodale, of Scone, which I have great pleasure in inserting, as the application of hellebore powder appears to me very perilous, excepting where it can be kept thoroughly under the eye of the superintendent. Mr. McCorquodale says:—"Twenty years ago I dusted my bushes with white powdered hellebore, and ten days after (being dry weather from the time they were dusted) a tart was prepared of berries from these bushes. After partaking of the tart we all got seriously ill, but recovered, and next day we were all right. Since that period I never again made use of hellebore for destroying caterpillars on Berry bushes. The remedy I have used ever since instead of hellebore, with equal success, is flower of sulphur. It is easily applied by dusting it over the bushes with a pepper-box while they are under the morning dew; or, if during dry weather, the bushes ought to be watered and then dusted. It is only necessary to dust the lower part of the bushes if taken in time. The use of sulphur is perfectly safe, and berries may be used at any time after its application." Mr. R. Service mentions it as very destructive at Maxwelltown, from June 5th onwards. At Ormskirk, Lancashire, Mr. R. Scowcroft mentions it had been much observed through the neighbourhood for its destructiveness, the larvæ taking to the Currant bushes after finishing the Gooseberries, of which they even attacked the fruit. At Huddersfield, Yorkshire, and Tranmere, Cheshire, it is also mentioned by Mr. Mosley and Mr. Gardner as very injurious, the bushes in both localities being in some cases stripped of their leaves. Mr. Bairstow, of Huddersfield, adds, "The Gooseberries have been devastated by the larvæ this year." Mr. J. B. Bridgman, of Norwich, says, "*N. Ribesii* is doing great mischief in the gardens, stripping Gooseberry and Currant bushes of every leaf, leaving only the stalks and larger veins remaining;" and, writing from Maldon, Mr. Fitch mentions the great abundance of this Sawfly everywhere. Hand-picking did not save the leaves of his Gooseberry bushes from being speedily reduced to skeletons, the quantity of food consumed in the time being almost incredible. Mr. Anderson mentions that near Chichester the first brood of *Nematus Ribesii* made their appearance from June 3rd to 17th on the Gooseberry and Currant trees. He notes that the eggs are laid in the nervures of the leaves, and the presence of the larvæ first shown by numbers of minute holes in the leaves, looking as if they had been riddled with shot; also that the habit of the larvæ appears to be to attack the lowest branches first, and work upward till they

have stripped the whole tree. A second brood of the Gooseberry caterpillar, still more numerous and injurious than the first, is mentioned as appearing on July 20th. The larvæ of the Gooseberry Sawfly are also mentioned as extremely abundant, and doing much damage to the foliage of the bushes at New Malden, Surrey. At Ashford, Kent, a few were observable in almost every garden, but little damage was done. Mr. Edward Parfitt mentions some gardens near Exeter as being much injured by this Sawfly. Mr. D'Urban notes the first observation of the larvæ on May 18th, then just hatching from the eggs on the leaves of a Red Currant against a wall; these leaves were picked off as fast as the young broods appeared, but a few grubs left were fully grown in about three weeks. They were not much noticed again till September, when the larvæ were so numerous as to strip every bush of Red Currant, and some of the Gooseberry bushes in the gardens in the neighbourhood, continuing to feed until after the frosts in the middle of October. Mr. D. Sym Scott, writing from Ballinacourte, Tipperary, mentions that only on one former occasion has he observed caterpillars of Gooseberry Sawflies as destructive to the Gooseberry and Currant bushes. These he first noticed on May 17th; and though the operation of hand-picking was commenced on the following morning they increased in numbers with extraordinary rapidity, extending in a remarkably short time over the whole garden. The weather was generally moist, and on some days it rained heavily. This insect is very troublesome, as if its ravages are not checked the productiveness of the bushes is injured for more than the season of attack. The habit of the Sawfly larva is to go down into the ground when full fed and there spin a cocoon, in which it undergoes its changes, coming up in summer as the perfect Sawfly in about three weeks; but in the case of the autumnal larvæ, remaining unchanged and curled up in the cocoons till spring, when they develop and come up from the ground when the Gooseberries and Currants are coming into leaf. For this stage skimming off the surface of the ground and burning it, with the contained cocoons, or the less complete remedy of digging, liming, sooting, or any other treatment of the ground under the bushes that would remove or kill the larvæ, would be of great use; but also for this and similar cases (though this is only a suggestion on my part) I think that Mr. Thomas's (of Ridgeovean) treatment for *Otiorhynchus* of placing tarred boards under the bushes, and causing the pests to fall on the wet tar (be they beetles or caterpillars), might be well applied. If the larvæ did not fall to a shake they almost certainly would to a good syringing with water as hot as the trees would bear, and the trouble and expense of the

application would be much less than that of hand-picking. In the case of the grub of the Asparagus Beetle, which holds very firmly, I have found almost all dropped to a shake after syringing with hot water, and I killed them on the ground with soot; and I believe (with whatever modification might be needed as to detail) that this remedy would be found of use with regard to many of the bush-feeding larvæ.

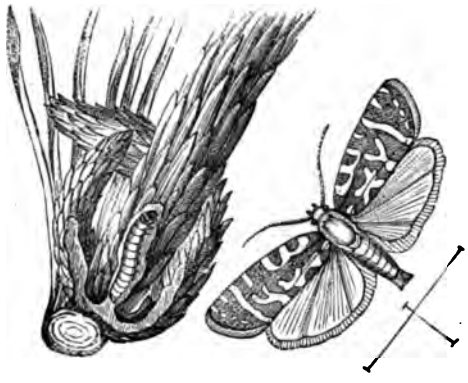


SIREX GIGAS.

29. Sirex Gigas. Giant Sirex. Mr. Matheson mentions this as having been rather common this year at Addington, Bucks, and that he has destroyed specimens in localities some miles apart. A few specimens were also noticed by Mr. John Upton, at Sedbury Park, about September 6th. Where felled Fir timber is found to contain this insect it would be well worth while either to utilise the logs at once in such part as is sound, or else to burn them, otherwise the insect will probably develop from them for successive years, to the injury of the neighbouring live timber.

30. Retinia, sp. **Turionana, Buoliana,** &c. Pine-bud Tortrices. Mr. Matheson mentions that the larvæ of one of the Pine-bud Tortrices has not been as injurious at Addington, Bucks, during this season as was the case two or three years ago, apparently in consequence of careful treatment. This moth attacks the Scotch, Austrian, insignis, and other species of Pine, the caterpillars injuring the leading shoots

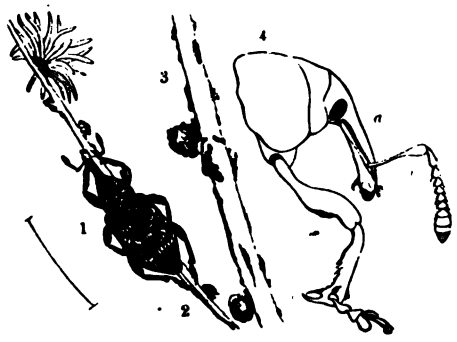
as well of the branches as of the main leader of the tree, and causing a stunted and deformed growth. He also mentions the best remedy he is acquainted with to be hand-picking, so long as the shoots are within reach. In many cases the damage to the special tree observed is done before the presence of the insect is detected, but even then if destroyed the number is lessened for the succeeding season. June and July are the best months for examining the trees, and one man can look over a large number; and to a continuance of this treatment for some years with many thousand trees Mr. Matheson attributes his present comparative freedom from the Tortrix. Mr. Herbert Morrell contributes a description of the attack of one of the Pine Tortrices on his Austrian Pines at Headington Hill Hall, near Oxford. He mentions that these Pines, when from two to six feet



RETINIA TURIONANA.

high, are almost all attacked by some insect of which the preliminary workings are not noticeable until (as about the end of February, at which his communication took place) a gummy exudation is noticeable at the base of the leading bud. In 1878 the injured buds, which showed a minute hole at the lower part, remained green till about the end of March. About May these buds were brown, and broke off easily to a touch, showing the grub within, occupying the whole of the bud and part of the stem beneath. Absence from home prevented the completion of the observation by capture of the imago, but it is obviously one of the Pine Tortrices; and it is mentioned by Mr. Morrell as spoiling hundreds of Pines in his new Plantations, invariably selecting the leading shoots; fortunately, however, leaving the *P. excelsa* and Spruce Fir untouched.

31. Hylobius Abietis. Fir Weevil. Of this Mr. McCorquodale, writing from Scone, Perth, speaks as a most destructive Beetle. In 1842 he mentions first discovering the ravages of this Beetle in a young Fir plantation that had been planted the previous year immediately after an old crop of Scots Pine was removed from the ground. After a crop of Scots Pine is cut and removed from the disforested wood-land the Beetle propagates in the scaly bark that falls from the trees during the felling of the timber, independently of the stools. They continue their work of devastation among newly-planted Scots Pine for five or six years after the timber is cut away. This insect is peculiar to Scots Pine. It does not frequent disforested wood-land after any other kind of tree, although it eats the bark of *Coniferæ* generally, and its destructive operations are incredible. In



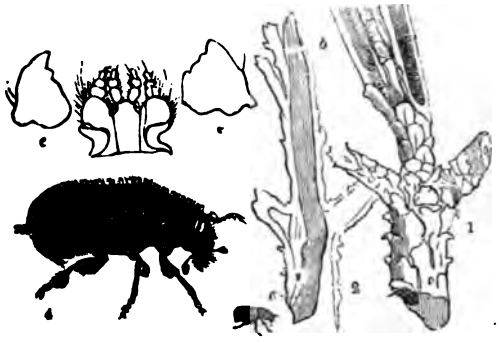
HYLOBIUS ABIETIS.

the case of a hundred acres being cleared out of old Scots Pine, and planted within four years thickly with *Coniferæ*, there would be few remaining uninjured in two years after. After many experiments Mr. McCorquodale was successful in finding a method of preparation of the ground, and treatment, which he adopts and finds to save the plants from the ravages of the Beetle. After the Pine crop is cut and cleared the ground is enclosed thoroughly, so as to exclude stock of all kinds, and if required is drained. The ground is permitted to rest the first summer for the purpose of getting up all herbage as strongly as possible, and in dry spring weather the whole is burned, so as to destroy the eggs and food of the Beetle, and, as far as may be, stamp it out. After this the ground should be planted with strong two-years' transplanted plants. After each young tree is planted a layer of earth is laid round it about two inches in thickness and eighteen inches in diameter; this layer should be beat smooth with the back of the spade

to prevent the Beetle lodging under any part of the rough surface. This treatment was found to answer very well, for as soon as the Beetle in search of food comes in contact with the bare earth it immediately steers its course in another direction and leaves the plant untouched. The Beetle is found to be most destructive in dry warm seasons. On August 30th I received some living specimens of *Hylobius Abietis* from Mr. W. Robertson, together with some young plants of Austrian and Scotch Pine, damaged by the Weevil, from Lady Reay's plantation at Blinkbonny, near Earlston. Mr. Robertson mentions that where replanting has been done in the Fir plantations, especially after a full crop of Scotch Pine, the Weevil has done a great amount of damage, in some instances completely destroying the newly-planted young trees. The Weevil is stated to die out naturally from three to six years after the crop of Firs has been cleared, and the insect appears to be less plentiful if the plantation is grazed by cattle. Looking at the habits of this Weevil in frequenting the rotting stumps in Fir plantations for breeding purposes, I suggested (as grubbing-up the stumps is too expensive an operation to be suitable on a large extent of ground) that the effect of tarring these stumps should be tried, as it could not fail to deter the Weevil from oviposition, at least for a long period. This experiment was about to be tried, but the result necessarily must be waited for. Mr. Robertson mentions that he has for some months been trying the effects of painting over the stem of the young trees with a mixture of paraffin oil and red lead, and it appears to have been fairly successful so far; but he does not consider that he has tried it long enough to speak definitely as to its power of checking the Weevil, or the effect on the trees experimented on. The *Hylobius Abietis* is also mentioned by Mr. McGregor, of Ladywell, Dunkeld, as doing damage in young Scots Fir plantations, planted after a crop of old Fir trees had been cut down; in this case hand-picking of the Weevils was adopted, and destroying them in boiling water.

32. Hylurgus Piniperda. Pine Beetle. This little Beetle is mentioned by Mr. McCorquodale, of Scone, as destructive to Pine plantations, at all stages from those newly planted up to fifty years of age. They attack the annual growths on the extremities of the branches by boring from the side of the tender shoot into the pith, and then follow the pith for an inch or two towards the point of the shoot. This is done in summer; and the following spring, during high winds, these shoots are blown off. The injury to side shoots is bad enough, but the effect of the leading shoot being blown off is for

the trees to be often bushy headed, and when the tree is thus affected it retards it in growth and reduces its ultimate value. When young Fir plantations are thinned all the brush ought to be at once removed or burnt on the ground, as this Beetle propagates in the decaying



HYLURGUS PINIPERDA.

branches in legions. They ascend the standing trees, and commit extensive ravages. When Fir thinnings are carted from the plantation it is a very common practice to dress the bark off to lighten the carriage in transit to market. The dressing off of the bark should not be permitted within the plantation; in a year after, the ground round these heaps of bark may be seen covered with grown shoots blown from the growing trees, bored by the Beetles which the heaps have nurtured.

With the above observations many other notes have been contributed, of which some are of considerable interest generally, but not being with regard to injurious insects are not available here. I have also been favoured with a few notes giving a general sketch of amount of insect presence in the Isle of Jersey, and round Denbigh, North Wales; and a few observations of injurious insects not noted in the list, which I now give, as well as some words regarding *Colias Edusa*, which, though not injurious, was included in our first Report, as possibly throwing some light on similar occasional appearances of other species. Through the hands of Mrs. Tourel, Les Pres, Jersey, I have a note of the spring and summer having been there (as elsewhere) unusually wet and cold, and insect presence less than usual.

Cockchafers have been little seen; and Black Aphis on the Beans, Green Aphis on the Roses, and American blight, have been less prevalent than usual.

Fruit crops, especially Pears and Apples, have been much injured by caterpillars, and the latter fruit much injured by grubs eating them to the core.

Late-sown Turnips were in some instances entirely destroyed by the "Black Fly," and the "White Thrips" (? *Aleurodes brassicæ*) has done much harm generally in the Cabbage crops. It is mentioned that the climate of the island is so favourable to insect-life that it is much wished the subject should be followed up.

Mr. Marsden, writing from Gwaynynog, Denbigh, North Wales, reports that Wireworms, and insects generally, have been as active and destructive as ever, notwithstanding the long-continued frost of last winter, and have also been unusually prolific during the excessive humidity of 1879; and that in many instances beds of Celery and other vegetables have been entirely destroyed by insect attack. From Mr. Marsden's account salt appears to be in frequent use in the neighbourhood, both as a deterrent to the Wireworm in the fields, and also in some gardens, where it is applied thickly around the vegetables to check the insect enemies. The effects of general blight and the ravages of insects have been specially marked on this year's produce; and Mr. Marsden mentions that farmers are naturally most anxious to ascertain what effectual means can be employed to check or exterminate the pests which do such injury to their crops, and would readily experiment with any remedy that might reasonably be supposed to be of service.

Ceutorhynchus sulcicollis. Cabbage and Turnip Gall Weevil. Mr. Webster notices that agriculturists have had much annoyance in the district round Fochabers, Banffshire, from the prevalence of the Turnip Gall Maggot; and Mr. Malcolm Dunn, writing from Dalkeith, Edinburgh, mentions that Cabbage, Savoys, and Cauliflowers have all suffered more from the attacks of *C. sulcicollis* than they have done for some years, although these attacks are partial, and confined to patches here and there. He mentions that a dressing of caustic lime, soot, or gas lime, is very beneficial, accompanied by deep trenching of the ground. When plants are seen to be attacked they should be at once removed and burned to destroy the larvæ, as they seldom arrive at a useful state afterwards. As soon as they are cleared off, the ground should be treated as above described. Mr. Philip Hannam, of Northbourne Court, Deal, also mentions lime as a very good preventive, and recommends "liming the ground to be planted with Swedes during the previous winter, not later than the end of January if possible." In the district round Isleworth, where Cabbage is one of the chief crops of the neighbourhood, this Weevil is

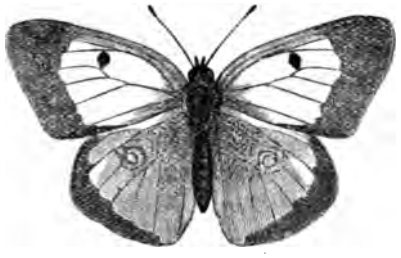
in some years excessively prevalent, so that heaps of many cart-loads of old Cabbage-stalks may be seen flung aside when the fields are cleared, all more or less covered with the Galls in various stages,

CEUTORHYNCHUS SULCICOLLIS.

some still with maggots contained in them. These maggots have great powers of endurance: on being removed from the Gall, even if not fully grown, they will at once construct earth-cases as if ready for pupation; and in the cold weather of last winter, out of a large number that I examined (with one exception), all were alive and healthy; and on being thawed after removal from the Gall and placed on soft earth they made their way into it and formed their earth-cases as usual. The numbers of this Weevil are much increased by the custom of merely throwing the old Cabbage-stumps, with still tenanted Galls in them, aside, instead of burning them; and where the stumps in this state have been buried to decay a little below the surface, and a fresh Cabbage crop planted above, the result has been very bad.

Phædon betulæ. Mr. D'Urban notes that he has received specimens of this Beetle from Mr. J. G. Burgess, of Magdalen, near Lynn, Norfolk, with details of the method of its attack on the White Mustard in the Fen country, where many promising crops that would yield five or six sacks of seed per acre are destroyed by this pest. It is mentioned as appearing generally about the flowering time, and first to attack the leaves, then the bark of the stem and branches, and finally to gnaw the pods till the seeds are visible. The seed in these cases is always small and grey, and almost unsaleable, not paying the

expenses of harvesting. The Beetles are noted as appearing first on the Mustard, but will also attack young Rape, and Mangolds in full leaf when growing near infested Mustard plants. A specimen of Mustard was forwarded, showing the eggs had been deposited in slits in the leaves close to the main ribs, and many holes had been eaten in the substance of the leaf by the perfect insects. Mr. Burgess mentions that in a dry season he has never observed these Beetles, but in showery weather they are very destructive, and at harvesting time may be found in almost incredible quantities on the crop. A severe storm of rain and hail appears to have been in this case the most efficacious remedy, though rather unfortunately neutralising the effect of a careful series of experiments as to the effects of various applications. In the Cabbage-growing district round Isleworth it is considered that fresh hops from the brewery are a very good means of keeping off the ordinary Turnip Fly, and the application might possibly have a good effect on the allied Chrysomelideous Beetle, *P. betulæ*.



COLIAS EDUSA.

Colias Edusa. Clouded Yellow Butterfly. Mr. Norgate mentions seeing a female on September 3rd at Brockenhurst, in the New Forest; and at Tangley, Guildford, it is mentioned as "scarce as usual." At Maldon a single much-worn specimen was seen by Mr. Fitch on September 26th. Mr. E. Parfitt mentions not having seen and only having heard of one specimen near Exeter this season. At Sedbury Park, West Gloucestershire, however, the Clouded Yellow is reported as having been seen in some numbers about September 29th, and the particulars forwarded, on special enquiry being made, left no doubt as to its having been this Butterfly. This observation of the continuance in the neighbourhood is of some interest, for in 1859 there was a sudden appearance of the *Colias Edusa* in such great numbers on one Clover field, at Sedbury Park, that I might have taken them readily in dozens; and although the Butterfly was very rare (or, I believe, unknown in the neighbourhood previously), I saw

it afterwards there for several years, The climate is soft and mild, and the ground a tongue of much-wooded land, about three-quarters of a mile wide, lying between the Severn and Wye, about 150 feet above the medium tide-level.

Liparis auriflua. Yellow-tail Moth. Mr. Dobson mentions the larvæ being very common at New Malden, Surrey, about July 6th, and the moths at the end of August. These larvæ are occasionally very destructive, especially to Whitethorn; and in 1782 were so excessively and generally injurious that (see Stephens's 'Entomology,' vol. ii. p. 66) orders were issued for prayers to be read in all the churches to avert their ravages. In the present case their appearance is coincident with excessively wet weather, as Mr. Dobson notes that from June 1st to July 27th there were not two dry days consecutively.

Aphides—taken generally—seem to have varied much in amount of appearance in different localities. Mr. Malcolm Dunn mentions that the first insect attack of note occurred about June 20th, when myriads of *Aphides* made their appearance on Apple, Pear, and Peach trees. They quickly over-ran the young growths, injuring the wood, and crumpling the leaves so as to cause them to fall. The fruit on the Pears and Peaches, being already of some size, suffered no material injury; Apples, on the contrary, were in many instances still in full flower, and the *Aphides* attacking the blossoms caused them to fall off prematurely, to the severe injury, and, in many cases, the entire loss, of the crop. In a very few days (three or four at the most) of favourable weather these pests did an immense amount of injury, attacking most of the plants that they affect in vast numbers; but a heavy night's rain swept all that were exposed to it entirely away, and the cold wet weather of July prevented those left doing much harm during the rest of the season. Some trees, and especially Beech, suffered severely during this outbreak of *Aphides*, some parts of Beech hedges in the district being so badly injured that they lost their leaves, and will probably succumb to the attack. Mr. Dunn observes that for an attack on a scale of such magnitude there is no practicable cure; but for plants of a moderate size, in the open air, syringing with diluted tobacco liquor or strong soapsuds is generally a very effective and most commonly-used remedy. Mr. Mosley, writing from Huddersfield, mentions that *Aphides* have been exceedingly numerous on almost everything; and at Addington, Bucks, Mr. Matheson notices the Green Fly as having been most troublesome on Plum and other trees. He also mentions the prevalence of a white *Aphis* on the roots of vegetables to such an extent as nearly to destroy some of the crops, such as Lettuce and some kinds of Cabbage. The Green Fly is also observed

as being unusually numerous at Aber Camlais, near Brecon. At Maldon, Essex, Mr. Fitch notices the remarkable absence of all species of *Aphides*.

Sawflies of Scots Fir and Alder. Mr. John McGregor, Ladywell, Dunkeld, mentions that the larvæ of a Sawfly (probably a species of *Lophyrus*) have been very injurious for the last three seasons on Scots Fir trees in a young plantation of two thousand acres, devouring enormous quantities of the foliage, and thereby doing much harm to the trees. On such an extent of ground it seems almost hopeless to think of applying a remedy; but on a small plantation of twenty acres, not within five miles distance of any other Scots Fir wood, an attempt was made to clear the trees, which has been so far successful. The plan adopted was to send a number of boys through the plantation, each furnished with a small vessel containing naphtha and a brush roughly made of feathers, with which the clusters of larvæ were slightly sprinkled or touched, when they immediately fell down; and by this means the plantation was almost cleared. Of the Alder Sawfly Mr. Edward Parfitt observes that it has been more numerous along the banks of the Exe than he has seen it for many years, and a large number of the trees have been completely defoliated by it.

With regard to the Insectivora I am favoured by Mr. F. Norgate, of Sparham, near Norwich (who has devoted particular attention to this subject), with valuable detailed observations, from which I give the following notes:—

Amongst various species of Birds serviceable generally on Forest trees, Apple trees, and Fruit bushes, Mr. Norgate mentions the Titmice, including the Blue, Cole, Marsh, Long-tailed, and Great Tit (and of these the Blue Tit may be especially observed at work amongst *Aphides* on Gooseberry bushes); also the Warblers, Woodpeckers, Nuthatch, and Tree-creepers. The Lesser Spotted Woodpecker is noted as especially frequenting the Apple; the Gold-crested Regulus frequents the Scotch Pine, Spruce, and other *Coniferæ;* the Bearded Tit, Yellow Wagtail, Titlark, Wren, Cuckoo, and Water Rail, are mentioned as serviceable in Osier beds and Reeds, and in Marsh Hay. Amongst Gooseberry, Currant and Raspberry bushes the Titmice and Warblers, the Wren and the Cuckoo, are noticed as of especial use. Amongst Cabbage and Turnip crops the Partridge, Spotted Flycatcher, Swifts, Swallows, and Martins, are serviceable (and also Shrew-mice, Moles, if not too injurious to agricultural work, and Bats). On Grass —besides the Warblers, Swallow, Swifts, Martins, and Partridges, before mentioned—the Wagtails, Pipits and Starlings were all of

service; and the Shrews and Bats, the Slow-worm and the Toad, help at the work. The Cuckoo is of especial service from not refusing hairy larvæ, and the Flycatcher as destroying the white butterflies; whilst Bats eat the moths of the surface caterpillars (Noctuæ of various species), and Shrews prey on beetles.

Some degree of discrimination is desirable in encouragement of Birds, as with regard to Starlings, which are noted as injurious to Reeds; and Rooks, again, which at times do damage in various ways; but, generally speaking, the encouragement of the Insectivora, whether Bird, Beast, or Reptile, would make a very important difference in the amount of insect presence.

I now offer a few remarks with regard to such of the Insects as are now first mentioned on the accompanying sheet.

It is almost impossible to give a description in words (unaccompanied by coloured figures or comparison with other specimens) by which the species of an insect may be known with certainty, but, agriculturally, it is usually the attack taken as a whole, not the various species of insects engaged, that is the important matter; and from this point of view the attackers are generally only too well known. Entomologically, such terms as the "Fly," the "Grub," &c., are not satisfactory, but, nevertheless, they embody the description of the cause of the attack truly, and sufficiently fully for practical purposes, for where all the insects concerned are of the same habits, do the same damage, and are to be got under in the same way, it is not necessary for the agriculturist to endeavour to distinguish each species.

If more information be needed—and where the insect is not known it is of great importance to be rightly informed on the matter—it is far better that specimens should be sent for naming. Any applications on this subject directed to Mr. Preston, Mr. Fitch, or myself, would be attended to with pleasure; and I only wish we were favoured with specimens more frequently; but the prevalent idea that something of Entomology must be understood to enable an observer to note how the insect injury is to be counteracted is a great mistake, and loses us many a valuable note. If the observer will send a specimen in case he does not know what it is, this is all the scientific Entomology with which he need trouble himself: he knows the practical part of how it feeds on his crops only too well; and it is the detail of this injury, the amount of loss sustained, or how it has been prevented or stopped, that we are anxious to have information of, and to spread the knowledge generally.

The insects named on the list are selected, as far as possible, as being the most injurious of the genus; but in one or two cases a species which is not widely distributed has been taken that we might have the advantage of an illustration showing a type of the genus. For these excellent illustrations we are, as before, indebted to the kindness of Dr. Masters, in allowing us the use of electros from the blocks belonging to the 'Gardener's Chronicle,' taken from the drawings of Prof. Westwood and the late Mr. John Curtis.

1. *Plusia Gamma.* Silver Y Moth. About an inch and a half across the wings when spread; the head and body purplish brown the former with the plumage raised so as to form a crest; the upper wings silky, and mottled with various shades of pinkish and brown, with a pale yellow or whitish mark on each wing, like the Greek γ; the lower wings smoky. The caterpillar, when full grown, is about an inch and a quarter long, green, with six white or bluish lines down the back, and a yellow line along each side. It spins the cocoon in which it changes on some part of a plant.

4. *Agriotes lineatus.* The Striped Click Beetle, or Wireworm Beetle. This may be known from the (also very common) *Agriotes obscurus* by having the wing-cases striped with alternately dark and light lines of brown, and rust or ash-colour. In *A. obscurus* the wing-cases are reddish brown or dusty black. The Click Beetles may be recognised by their shape, as given in fig. 4; also by their power of regaining their right position when laid on the back by giving a sudden spring accompanied by a loud click; and the true Wireworms are larvæ of these Beetles, but from their likeness to other "pests" some confusion exists very often on this subject. The true Wireworms are yellow or orange, almost cylindrical, shiny, and so hard that it is difficult to crush them, and altogether are remarkably like a piece of yellow wire. They are distinguishable from Centipedes and Millepedes by having only six legs placed in pairs on the three segments immediately behind the head, and have also one sucker leg at the tail. From the Crane Fly grub, which bears the name of Wireworm very generally in Scotland, they are distinguishable by *having* legs; the Crane Fly grub has *none*.

10. *Aphis rumicis.* Collier; Black Dolphin; Black Fly (Scottice). The well-known black *Aphis* of the Beans, commonly named from its sooty colour. The males with four wings, slightly tinged with brown, and with brown nerves; the females wingless, with ochreous legs.

13. *Agrotis segetum.* Turnip Moth, or Common Dart Moth. This is from an inch and three-quarters to two inches in the spread of the wings, and very variable in colour; the fore wings are freckled with

brown, with two waved lines at the base, a double waved line beyond the middle, and a still more irregular one at the edge of the wing, accompanied by various oval or ear-shaped spots of various depth of tint, and other markings too complicated for a short description. If the Moth is not certainly known it is best to forward it. The caterpillars grow to about two inches in length, and the thickness of a small goose quill, and are of a freckled ochreous colour with a broad space, often rosy down the back, bearing a double dark line with a fainter one on each side, and two black dots placed on each segment between these lines; the first segment behind the head is brown, divided by three pale lines. The caterpillar is of a shining horny appearance, and on disturbance rolls itself up.

14. *Phyllotreta undulata.* Turnip Fly. The Turnip Fly, or Turnip Flea Beetle, is only too well known. Of the many species *P. undulata* and *P. nemorum* appear to be the most destructive. Both species are striped on the wing-cases, and distinguishable from each other by the fact of *P. nemorum* being the largest, the most coarsely punctured, and having yellow shanks.

16. *Aphis Rapæ.* Turnip Aphis, or Turnip Plant Louse; Blue Fly (Scottice). Females wingless, green, with a shagreened surface. Males four-winged; wings with light brown nerves; colour ochreous, or (taken in detail) green mottled with ochre and black.

20. *Aphis granaria.* Wheat Plant Louse. Females often wingless; green, with green and black legs. Males four-winged; the upper wings with a long green streak near the front edge. These *Aphides* change after death to a brown or ochre-olive colour.

21. *Cossus ligniperda.* Goat Moth; Ogger or Augur Worm (Scottice). About three inches in expanse; fore wings rich brown, varied and mottled with darker markings, crossing the wings in waved lines; the hinder wings somewhat similarly marked, but of a dull pale brown. The caterpillar is flesh-coloured in its early stage, with a black head, and broad dull red stripe down the back; the colouring becomes more definitely red on the back and orange at the sides as the caterpillar gets towards full growth, when it is as much as three to four inches in length. It is distinguishable by the disagreeable smell from which the Moth takes its name.

22. *Zeuzera Æsculi.* Leopard Moth. About two inches and a half in expanse of the wings, which are semitransparent; fore wings whitish, with many blue-black spots; hind wings with spots less distinct; thorax whitish, with six large black spots; body grey. The caterpillar is yellowish, with glossy black spots.

23. *Bombyx neustria.* Lackey Moth. This is about an inch and

a half in expanse, and very variable in appearance; the fore wings sometimes red-brown, with two pale transverse bars, or yellow with dark brown bars; the hind wings red-brown, generally paler than the fore wings, with a faint bar across the middle. The caterpillar is gregarious, and very gaudily marked; the head and second segment blue-grey, the first with two eye-like spots, the second with four black spots; all the other segments are striped throughout; a central white line runs down the back, and on each side of this are successively a thin black line, then in stripes, orange-red, black spotted with blue, orange (narrow and interrupted), broad blue, orange dotted with black; and below the caterpillar is blue-grey dotted with black. The eggs are laid in rings on the Apple shoots; and the caterpillars cause much damage by spinning up the leaves and young shoots in their webs.

24. *Yponomeuta padellus.* Small Ermine Moth. This little Moth, which averages about three-quarters of an inch in the expanse of the wings, is extremely variable, the ground colour of the fore wings being sometimes white, sometimes pale or deep lead-colour; each fore wing has about thirty minute black dots on it, placed in three slightly-irregular rows; the hind wings are lead-colour. The caterpillar is of a dirty ash colour, spotted with black.

26. *Anthonomus pomorum.* Apple Weevil. The Beetles are hardly a quarter of an inch in length, and pear-shaped; reddish brown, with short whitish or ochreous hairs. These minute Weevils come out from their winter shelter in March, when the blossom-buds of the Apple are swelling, and in some years materially injure the crop by laying their eggs in the buds, so as to prevent their future development into fruit. The males fly, but the females usually crawl along the bough; and probably much might be done towards checking them in the Orchards of the cider-growing counties, where they are the most injurious, by removing ragged bark, and the enormous masses of Lichens, Mosses, and other shelters for insect vermin, which in many parts of the West of England are allowed to accumulate on the trees.

27. *Eriocampa adumbrata.* Pear Tree Slug-worm. The perfect insect is a Sawfly; black with a violet tinge, and with blackish wings. The larvæ are easily distinguishable by their shape, which (as shown in the figure) is so much swollen behind the head as almost to conceal it; and also by the bottle-green or black grubs being coated with slimy adhesive matter, giving them a truly disgusting appearance during their early life. When they are about five weeks old they cast their skins, and appear wrinkled transversely instead of being wet and slimy, and of an ochre-colour instead of black or bottle-green. The

number of synonyms for the common Slug-worm, and also the doubts as to whether two species do not really pass under one name, make the subject rather difficult; but the above description will convey the general appearance of the larva, sometimes so injurious to the Pear leaves.

28. *Nematus Ribesii.* Gooseberry and Currant Sawfly; Gooseberry Caterpillar. This Sawfly is ochreous, with an orange-coloured body; the wings iridescent, with brown nervures. The larvæ, when about three-quarters of an inch long, are dull pale green, with the segments next to the head and tail of a deep yellow; head, feet and tail black, and black spots on each segment, sometimes arranged in rows down the back. When full grown the caterpillars cast their skins, and appear of a uniform pale green, and still with the yellow segments, but without the black spots, excepting two little black dots on the head. They go down into the earth to change, and spin a yellow-coloured cocoon, as previously mentioned, from which the summer brood hatches in about three weeks; but the autumnal brood lies unchanged, buried in the cocoons in the earth till the following spring, when they develop as the Gooseberries and Currants come into leaf.

30. *Retinia Turionana.* Pine-bud Tortrix. This moth is somewhat under an inch in the expanse of the wings; the fore wings bright orange, with several irregular or bifid transverse silvery streaks; the hind wings dusky lead-colour. The larva is glossy, of a dark purplish brown; the head, and transverse patch on the second segment, black. When full fed it turns to pupa in the Pine-bud, on which it has been feeding. Various species of Pine-bud Tortrix are injurious to Pines, and remedies found to be of practical use would be of great value. The species named is sometimes injurious in England, but not generally so much so as other species of *Retinia;* it is selected that we might have the advantage of the figure of a type of the genus, and its method of injury.

31. *Hylobius Abietis.* Fir Weevil. A pitchy black Weevil, about half an inch in length, mottled with irregular wavy bands of downy yellow on the upper surface, and so much rounded at the sides as to be almost cylindrical. This Beetle is furnished with a long thick proboscis, and thence occasionally bears the name of Elephant Beetle.

32. *Hylurgus Piniperda.* Pine Beetle. This minute Beetle is only from one to two lines long; black, slightly downy, with pitchy legs, and dull red antennæ.

It now remains for me to express my hope that those who have hitherto assisted will continue their contributions for the next year's

Report. The subject is one of great importance to the country, and can only be met by well-grounded practical measures; what these measures are we can only tell from the experience of those who have carried them on in the different methods required by different soils, weather, and surroundings. It has been said we want statistics of the amount of loss from insect injury. It is hardly possible to give these disconnected from other points; but for those who wish to follow up the subject there is much information as to the amount of destruction our injurious insects are capable of, and the extent and amount of loss by special attacks, in the earlier volumes of the 'Journal of the Royal Agricultural Society,' in the 'Transactions of the Entomological Society,' and occasional notes in the reports of the crops in the 'Gardener's Chronicle and Agricultural Gazette.'

Those interested practically in the subject do not need information, but to the outside observer the reflection that "the crop had to be resown" means that the labourer's wages, cost of use of horses and implements, and cost of seed, were thrown away, besides many incidental expenses, including, in some cases, a certain amount for rent of land that has made no return, will give some general idea of the loss (or the proportion in which in lesser attacks it is to be calculated) per acre. If we look at the notes in this Report there is scarcely one observer who does not record definite loss; and this is hardly as one in a million to the amount which, in the aggregate, makes up what has this year been lost to the country at large.

Many of those whose constant occupation keeps them from studying what is needed, and who find that the regularly stated remedy for the attack frequently fails them from want of adaptation to their particular circumstances, would be happy to benefit by the advance in knowledge of the last few years as to remedies tried and proved to be of service in different soils and different agricultural and climatal circumstances, and would probably in return make their own experience known if they had the opportunity.

Any notes or communications will be received with pleasure, as before, by the Rev. T. A. Preston, Marlborough; E. A. Fitch, Esq., Maldon, Essex; or by myself, at Dunster Lodge, near Isleworth; and any information wished for will be gladly given as far as it may be in our power.

E. A. ORMEROD, F.M.S.

Dunster Lodge, near Isleworth.
December 19th, 1879.

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NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORT, 1880.

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NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS.

REPORT, 1880.

The season of 1880—as shown by observations from the North-East of Ireland, the Isles of Orkney and Mull, and from various localities ranging from the North of Scotland to the South of England—has been remarkably suitable for vegetable growth by its alternations of dry and sunny weather, with storms or periods of rainfall to press on the crops; and from most of the localities where the weather has been thus favourable there are also returns of little amount of insect injury. The great insect attack of the year has been that of the *Tipulæ* larvæ, commonly known as Daddy Longlegs grubs. There has also been severe damage in some localities from the grub of the Carrot Fly and of the Onion Fly; thus showing the chief injuries of the season to have been from larvæ of the Diptera, that is to say of the two-winged flies, which—in the case of the Daddy Longlegs—are known to be most prevalent in wet vegetation and in wet ground, such as was caused generally throughout the country by the continued rains of 1879.

This attack of the *Tipulæ* was not, however, quite universal. It is mentioned by Mr. Service as not occurring to a hurtful extent in the neighbourhood of Dumfries, where he notes there was a winter of fine weather, followed by a cold and dry spring; and the weather report, contributed by Mr. F. Grant Findlay, from meteorological observations taken in the same neighbourhood (at Castlemilk, Lockerbie), shows the same fine state of the weather in detail. Taking the months of January, February, and March, the min. temp. of these (read from exposed thermometer) was respectively 12°, 27°, and 21°; the max. temp. (read from thermometer protected in shade), respectively 48°, 48°, and 59°. The number of days on which rain fell in the same

months was respectively 4, 6, and 6; and the hours of sunshine in each month were 46, 79, and 166.

The minimum of January is thus seen to be somewhat higher than at Kingsnorth, Kent, where Mr. Hart mentions his thermometer as registering several times below 10°, and higher also than at my own station, 68 feet above sea-level near Isleworth, where the min. reading for the month was 11°; here the days of rainfall in the whole period noticed were more numerous than at Lockerbie, occurring in the above-mentioned months, near Isleworth, respectively on 7, 20, and on 4 days. The temporary changes in the state of the weather were in some cases highly beneficial in clearing away insect attack; in a few instances they were favourable to increase. From various localities we have notes of the rains clearing the Turnip "Fly," and also the beetle, *Gastrophysa polygoni*, when injuring the Mangold crops in Shropshire: the benefit was both from washing down the insects and invigorating the plant-growth. Cabbage Butterflies, which appeared in great numbers on the coast of North Wales, near Llandudno, on the 26th of March, are noted from several places during the summer as occurring with, or immediately following, a duration of dry weather.

The Clouded Yellow Butterfly, *Colias Edusa*, and the Silver Y Moth, *Plusia Gamma*, which appeared respectively in such vast numbers in 1877 and in 1879, were in the first case scarcely represented; in the second but little noticed. The injurious beetles made no great appearance. Amongst injurious Hymenoptera the Gooseberry Sawfly, as usual, appeared almost in every locality where the simple means of prevention were not adopted of removing the surface-soil during the winter from under bushes which had been infested in the previous season. Wasps also have been an almost universal annoyance, reaching its height apparently near Dumfries, and the not distant locality of Glenarm, Antrim, in each of which places both ground and tree nests abounded to an extent that in the first made walking in the copses a matter of some risk from the number of nests suspended from the boughs, and in the second locality prevented the meadows being properly worked. Details of the species and numbers of nests observed are given, which space does not allow me here to insert. Other kinds of Hymenoptera, such as Gall Flies, and insects generally allied to the Wasps and Bees, do not appear to have been largely represented, unless by Humble Bees (*Bombi*) in some localities.

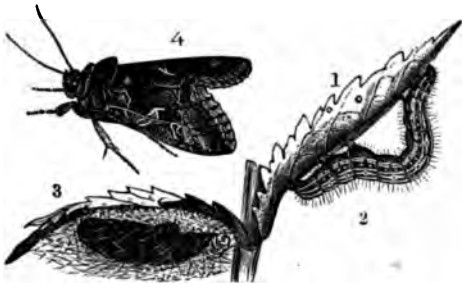
On the whole the weather appears to have been favourable to vegetation, and coincidently with this the amount of insect injury, with the exceptions noted, has been moderate.

I have to express great obligation to the many contributors who

have this year favoured me with notes of methods of cultivation found successful for prevention of insect injury; and, on my own side, I must add that as space does not allow of the notes being in all cases inserted at full length, I trust that the form they are given in may meet with the approval of those who are good enough to entrust me with their observations. With regard to the arrangement I endeavour to classify the notes in order, showing (as may appear best in the case of each insect observed), the general amount of presence or absence; methods of cultivation found serviceable for prevention; chemical or other applications found to be useful or clearly proved to be useless on careful trial; or where no other arrangement appears more desirable the notes of observation are placed in geographical order.

I have great pleasure in being allowed to mention that many of the present contributors, and many others also well qualified to give sound practical information on the subject of prevention of injury by insect ravages to our food crops, forestry, and fruit, have kindly promised contribution of their notes in the coming season.

Before proceeding to this year's observations, I have also to offer my acknowledgments to Messrs. Blackie & Son, Glasgow, for the reproductions from the beautiful figures given in Curtis's 'Farm Insects,' many of which, by their kind permission, are introduced in the present Report; and also to the Editors of the 'Gardeners' Chronicle' for the continued use of the figures, by J. Curtis and Prof. Westwood, with which they have hitherto obliged me.

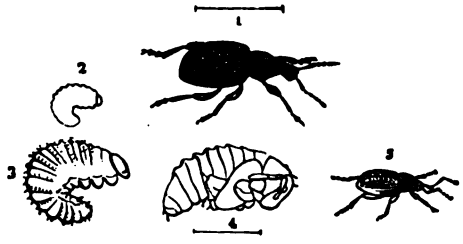


PLUSIA GAMMA.

1. Plusia Gamma. Silver Y Moth.

This Moth, which was the great insect appearance of 1879, has been merely noticed in small numbers and in few localities during 1880. Mr. Edward Parfitt observes that up to the 17th of September not a single specimen had been seen in the neighbourhood of Exeter. At New Malden, Surrey, and at Kingsnorth, Kent, it is noticed as scarce this season. At Maldon, Essex, Mr. Fitch notes the Moth as

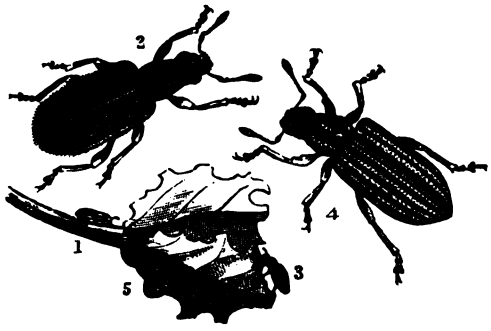
much rarer than usual, and that he had not observed a single Caterpillar. At Sparham, near Norwich, three specimens of the Moth, faded or injured (as if hybernated imagos of the year before), which were seen during the summer, and four or five fresh ones captured in the middle of September, were all that were noticed. Mr. Malcolm Dunn notices that it is seldom troublesome in the district of Dalkeith; a few were seen hovering about Lettuce and Peas in August when the weather was dry and warm, but they did no serious injury. Mr. Dunn notes that when the Caterpillars are seen, a dusting of caustic lime, soot, or salt, is a good remedy, and hand-picking a sure but very troublesome one. Mr. Anderson also mentions that a few were seen near Oxenford Castle, Dalkeith, in the spring, but scarcely any in the autumn; it is noticed as moderately abundant at Craighall, Perthshire, by Mr. Robert Coupar.



OTIORHYNCHUS (sp. SULCATUS and PICIPES).

2. Otiorhynchus sulcatus. Black Weevil. This was not common during the past season at Dalkeith, the worst attack being on the roots of some Vines in the neighbourhood, which they severely injured by gnawing and eating them. Mr. Dunn notes that the best remedy is to clear out the soil of the Vine border, and replace it with clean fresh soil. Watering with strong solution of ammoniacal liquor and common agricultural salt is effective in preventing their increase. Mr. Russell mentions that this Beetle is usually very numerous and destructive at Poltallock, Lochgilphead, Argyllshire, on Peaches and Vines, but few were seen this season. Hand-picking by lamplight is found here to be the best remedy for the Beetle. These Weevils did not reappear in Mr. D'Urban's garden at Exeter, where in 1879 they were thoroughly cleared from the Raspberries by the use of a sweeping-net. Mr. Lyddon mentions them as rather scarce round Warminster, and also notes their power of endurance of cold, and in my own garden (where hitherto they had not been observed) I found some larvæ, which I conjecture to be descended from the specimens experimented on with regard to endurance of temperature, reading as low as 11° 8′ in the previous winter. These were doing damage to

some choice Primrose roots, and to check the attack I dug up the plants at once with the earth attached, and dropped them to the bottom of a small cask of water. Here they remained for upwards of a day and a night; the roots were thoroughly cleared, and the plants did not seem the worse for the immersion. The holes caused by their removal were filled in with gas lime, and the attack appears to have been checked. Mr. Scowcroft mentions soot as a decided protection from the Weevils as long as the disagreeable odour lasts. Mr. Mosley, Huddersfield, reports that he has found the plan of putting tarred boards and shaking the Beetles down on them at night greatly reduces their numbers.

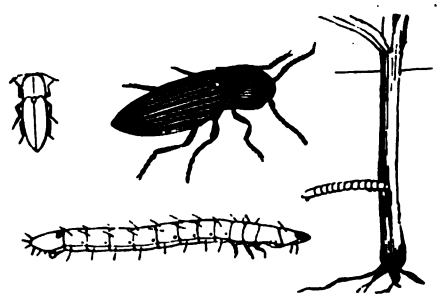


SITONES.

1. *S. crinitus.* 2. Ditto, magnified. 3. *S. lineatus.* 4. Ditto, magnified.

3. Sitones lineatus. Pea Weevil: Cuddies. Mr. Fitch notices that hybernated specimens were very abundant near Maldon, flying about in the few fine days of early spring after the frosts (31st January, 18th, 22nd, and 26th February, 1st March, &c.), but later in the year they were far less common than usual, and the Beans, Peas, and Clover were hardly attacked at all, and certainly not to any injurious extent. At Maxwelltown, Dumfries; Sedbury Park, and Little Faringdon, Gloucestershire, they are noted as not numerous, or as less plentiful than in former years. Mr. Long mentions the Pea Weevils have not been as numerous at Henlow, Biggleswade, as in some previous years, when he has had as much as sixteen acres spoiled by them. He notes the difficulty of dealing with the attack, as "in the dry state of the soil at the time—the only time when this pest does much harm"—pressure of the ground such as might diminish the sheltering spots of the Weevil would hurt the plants, and any dressing thrown on the leaves to prevent attack would not hold. Mr. Long adds he now diminishes his risk by the smaller breadth sown. At Kingsnorth, Kent, no perceptible amount of damage was done, but it is mentioned by Mr Hart that, at the time

of Pea carrying, the Weevils were so abundant that the waggons were fairly alive with them. Mr. Loney mentions that at Marchmont, Berwickshire, about the 7th of May, his third sowing of Peas was so badly attacked that, although top-dressed with quick-lime and watered with gas-water, this had no effect in stopping the ravages, and the crop was soon destroyed. The next sowing that vegetated, about the 20th of May, was clear of the Weevil. The Pea Weevil did comparatively little damage in the district of Dalkeith. It is noted that a dressing of lime or soot given to the Peas, after wetting them to make it stick, is an easily applied and generally effective means of preventing attack. At Langwell, Caithness, Mr. Sutherland uses turf or wood ashes in sowing, and is not much troubled by the Pea Weevil. The turf is broken small, and a little is put in the drills; the Peas are then sown, and a little more is placed over them. The ashes, which are from trimmings of dry vegetables, weeds, &c., are used similarly. Mr. Sutherland notes the importance of new seed, and also of a fresh sweet soil. In my garden near Isleworth, where the soil is a stiff loam, I have had success from sowing the Peas in the drills completely in coal ashes. They are thus in favourable circumstances for healthy germination, and there is no risk of soil being caked hard, so as to keep down the first shoot; the growth is vigorous and hearty, and soon puts the plant beyond the power of any common Weevil attack.

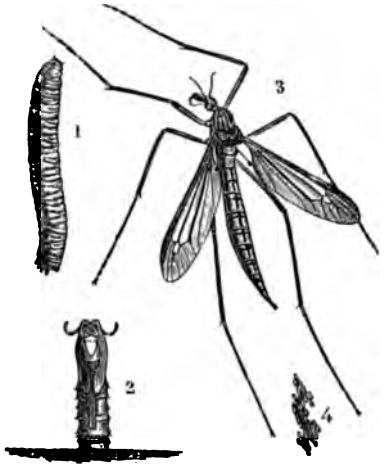


AGRIOTES LINEATUS.

4. Agriotes lineatus. Wireworm. Mr. Fitch mentions the Wireworms as far rarer and less destructive than usual this season in the neighbourhood of Maldon. Mr. Lyddon also notes them as not observable on the chalk and greensand round Warminster, Wilts, and ascribes their absence to good cultivation. They are mentioned by Mr. Coupar as very numerous in grass fields near Craighall, Perthshire. Mr. Loney mentions that the Wireworm was formerly very destructive at the gardens, Marchmont, Berwickshire, but now, following on the practice of deep trenching, he is little troubled by it;

and Mr. J. Russell also mentions the Wireworm as not as numerous as usual at Poltallock, Argyllshire. In many places, however, they have been injurious, and in garden treatment the remedy of trapping in pieces of Carrot or Potato has been found to succeed well. Mr. R. Service mentions that at Maxwelltown, Dumfries, the Wireworms are so numerous that some garden flowers can scarcely be grown owing to their ravages, and he mentions that pieces of cut Potato buried as traps, and examined every morning, are very effective means of destruction. Mr. Malcolm Dunn mentions the most simple and generally successful remedy being pieces of Carrots or Potatoes fixed on the end of a short stick, and inserted in the ground where the insects abound. Examined daily, the insects are found sticking to them, and are picked off and destroyed, the traps being again inserted in the soil, and renewed till the Wireworms are all caught or disappear. In fields where Wireworm abounds, dressing with pulverised gas lime, or a good rolling with a heavy "Crosskill" roller, is effective in checking their attacks. Mr. Boyd, writing from the gardens, Callendar Park, Falkirk, where the *Agriotes lineatus* has been numerous, observes: "I commenced at once with Carrots and Potatoes inserted in the border two feet apart, and six inches deep; I gathered the insects every other day, getting large quantities at first, and continued all summer, and now at the present date there are very few left." This was early in October; at the beginning of the operations as many as twenty-seven were to be found at the root of one plant. Mr. M'Kinlay mentions that 400 to 500 a day of these Wireworms which were infesting a Vine border near Edinburgh were taken by means of Potatoes and Carrots laid for them. Mr. James Kay, writing from the Bute estates, Rothesay, gives an account of a method found successful in stopping attack of Wireworms on a field of Turnips. In 1876 four acres of orchard ground which had been laid down four years previously in grass was trenched, manured with partly crushed and partly dissolved bones, and sown with Yellow Aberdeen Turnips. The crop looked well until after thinning, when it appeared to come to a complete standstill, and on examination the greater portion was found to be much injured by the Wireworm near to the surface of the ground. As a preventive from complete destruction, Mr. Kay procured a quantity of fine dry sand, and moistened it with just sufficient paraffin for it not to clog, but run freely in the hand. Several women and boys were set to strew this slightly "in spoonfuls" along the centre of the drills, so as to fall directly above the roots of the plants, the whole crop being gone over in one day, and the effect was thoroughly satisfactory. The attack was stopped, and in a few days the plants recovered their vigour, and resulted in a splendid crop. Mr. Long notes that on his land at Henlow, Hertford-

shire, the Wireworm did considerable damage both to Barley and Wheat, so much so as to necessitate re-sowing in the case of one field of Barley. He mentions the only remedy that he is aware of being early pressure of the ground, so as to prevent the Wireworms passing from one plant to another; but in this season (1880), owing to the very dry state of the soil after March, the land would not compress sufficiently for this purpose. The loss on twenty-five acres, estimated rather below than above the mark, was £75. Mr. Hart mentions that he first found the Wireworms troublesome on May 7th, in Wheat and Barley, on his ground at Kingsnorth, Kent. As soon as practicable he put a heavy roller on the Wheat, and trod the Barley with young sheep (tegs); this prevented the "worms" from running; but the weather being cold and dry the plant made no progress, and by the 13th the Wireworm was as busy as ever in the Wheat. Harrowing and rolling were again resorted to, and the worm kept from spreading, but not before it had seriously thinned the plant in patches. One piece of Wheat was so severely eaten that it was ploughed up; after working and pressing the ground well it was re-sown with Oats. But the Wireworm was still there: the attack recommenced, and eventually the Oats also were ploughed up, and the land re-sown with roots. The Barley fared better, "probably from the earth being loose and more easily compressed." Mr. Freestone, writing from the Manor Park, Little Ilford, notices the Wireworms as "less troublesome, in consequence of the largest quantity of Moles we have ever had, being nearly over-run with them, even taking up their abode in the Cucumber frames." Mr. Sym Scott writes that at Ballinacourte, Tipperary, he has not seen any Wireworm; although a field of Oats followed on very old lea, and the farm comprehended a variety of soil and situation, there was no trace of damage. Mr. Scott advocates top-dressing meadows early in autumn, brushing the surface with a moss harrow, or heavy brush-harrow, and rolling as a means of destroying the egg of the Beetle, and consequently the Wireworm. Dr. R. J. Mahoney, of Dromore Castle, Kenmare, Kerry, mentions that he has used salt as a preventive for the Wireworm with considerable success. Mr. J. Kennedy, writing from the Lodge, Lake Cara, on the West of Kerry, mentions the mild climate as very favourable to insect life. Much of the occupation of the neighbourhood is cutting peat; and Mr. Kennedy mentions that the water in the pits drives the Wireworm to the top of the ridges, where they can be rolled. A stone roller is used for this purpose. At Glenarm, Co. Antrim, Mr. Brunton makes no mention of Wireworm attack this season.



TIPULA OLERACEA.

5. Tipula oleracea. Daddy Longlegs; Crane Flies.

This Grub has been the most destructive of the Farm pests of 1880. The parent Flies, commonly known as Daddy Longlegs, or Crane Flies, deposit their eggs either amongst damp grass or leafage, on the surface of the ground, or just below the surface, choosing especially such situations as damp meadows, Clover leas, hedge sides, and the like; consequently the season of 1879, when all was damp, suited them admirably; and a few notes in detail of the ravages of the Grubs from last autumn's eggs, and their cost, may help to give some idea of the loss entailed by a wide-spread attack of this kind to the country at large.

The first observation was forwarded during February from Mr. J. Harrison, Wilstrop Hall, near York, who mentioned that the Grubs were destroying hundreds of acres of autumn-sown Wheat on heavy land in the district, doing their work with great rapidity. In one field of twenty acres, that was especially observed, they had destroyed almost every plant within a week or ten days, althongh seven cwt. of salt had been applied per acre. The pest was only observed there on Wheat sown after clover.

Early in the year, also, Mr. Scowcroft mentioned that at Ormskirk, Lancashire, "the Grubs swarm in almost countless numbers where last year's crop was grass; and a number of farmers are again paying for having them hand-picked." At the Birches Farm, Tenbury, Herefordshire, they were also reported as very destructive in May; 40,000 Cabbages had been planted, and the Grubs were working amongst them. Salt and lime were found useless. Mr. Marshall, writing in

June from Winteringham, North Lincolnshire, reports that on the strong alluvial land, especially that adjoining the Humber, the *Tipula oleracea* Grubs were most destructive amongst Barley, and also present in February-sown Wheat. Many fields were consequently stripped of vegetation; as many as twenty-five Grubs could be counted to the square foot, and in some cases the crops were consequently ploughed up, and the ground planted with Rape and Mustard, to be sheep-fed off in September. Mr. J. Searsby, writing on the 10th of May from Firsley, Spilsby, mentions the Grub as having been eating the Wheat down since February, and that caustic lime and salt were both found useless; soot was of some small benefit by killing a few of the Grubs. Mr. Hart mentions that the Grubs were troublesome throughout the spring at Kingsnorth, Kent, but he does not consider that they had a bad attack on any crop, and hoeing, harrowing and rolling were sufficient to prevent any serious damage. Mr. Charles Foran, writing from Eastbourne, says of the *Tipula oleracea:* "Was not so numerous as last year, when they cleared patches of grass; this I attribute to the Starlings, which fed on the larvæ during the early months."

Mr. Fitch notes as follows regarding the *Tipulæ* on his ground at Maldon, Essex: "*Tipulæ* larvæ were exceedingly destructive everywhere. I had twenty acres of November-sown Peas intended for early podding, which until April looked perhaps the best crop in the neighbourhood. Throughout that month they suffered severely from the attacks of *Tipulæ* larvæ." These larvæ were to be found up to four or five in number at the root of one Pea; they injure the plant by eating away the bark just at the surface of the ground, or rather below it, thus weakening all, and killing many, of those they attack. They were "also very abundant throughout April in Wheat; where a sod or tussock of grass was hoed up or pulled up five or six larvæ were often found under it; here they grow to very large fat chaps, much finer than those in the Peas." In this case the Flies proved to be *Tipula oleracea*. The young Grubs in April and May were like short broken pieces of Earthworm, but somewhat darker in colour. The only remedies that Mr. Fitch considers as applicable are frequent hand or horse hoeing, the former being preferable. This disturbs the working of the Grub, exposes many to birds, animals, &c., and kills some; but it is "a dear remedy against a bad attack," as they lie in the earth so very close to the roots and stems of the plants. Mr. Fitch mentions the loss in his Peas was quite £5 per acre in the crop, besides the expense of frequent hoeings (five at from 4*s.* to 5*s.* 6*d.* per acre); first to combat the Grub attack, afterwards to keep down the weeds, which is always a difficult matter in a thin crop. "My field of twenty acres only realised £110 when picked on June 23rd; whereas in March, before the *Tipulæ* attack, certainly less than £10 per acre could not

have fairly been expected. With regard to subsequent appearance of the Flies Mr. Fitch notices that they were common, but not unusually abundant; and he considers the dry weather of May did much to get rid of them by hardening the heavy land, which to a great extent stops the "travelling" of the Grub, and also rubbish hoed up died, so that the Grubs were fairly starved out.

Mr. S. Fitton, of Cheerbrook, Nantwich, Cheshire, favours me with details of experiments tried by himself, or at his desire, which are of much value in showing the power of the Grub to endure poisonous applications (and consequently the little profit which often ensues on large outlay in these materials), and which also show the benefit arising from application of stimulating manure in such form as washes down at once to the roots, and so helps to carry the plant over the attack. The field observed was a seventeen acre field of Oats, in Clover the preceding year, and the attack commenced before May. On first discovery, the application of a heavy roller was tried, which did no good; afterwards a dressing of salt at the rate of three cwt. per acre was applied throughout the entire field, but also without success. Subsequently a heavy dressing of soot was applied to about three acres; three acres were spread over with rape cake, to the extent of four cwt. the acre; and four acres were dressed with quick-lime. After the lapse of a week no difference could be detected in the state of the portions thus treated and the rest of the field to which only salt had been applied. Mr. Fitton then sowed ten acres of the ground with guano and salt mixed at about the rate of four cwt. to the statute acre, and since then Mr. Fitton noted (writing on the 25th of May) he could not perceive any further damage, the repeated applications encouraged the plants, and the field was of a good colour, and for the most part looked well, though on inspection was thin of roots, the amount of plant destroyed being then estimated as follows:—Nine acres, about one third destroyed; five acres, one half ditto; three acres, two-thirds ditto. As the matter then stood, the loss fairly to be estimated to the yield of the coming crop was at "the rate of twenty measures the acre," and to the straw at the rate of ten cwt. the acre; besides the expense of the remedies and the application thereof, which was a good deal; "the field was rolled, harrowed twice over, and about two acres were resown." In this case, however, Mr. Fitton's treatment in the use of stimulators brought the crop through beyond hope. By the 1st of July the greater part of the field was in hearty growth, averaging three feet high and of a rich colour; and on the 27th of September the report of the field was that (with the exception of one acre that had been almost destroyed before any remedy was attempted) there was a very heavy crop. The stack from the field measured thirty-four yards long by five yards wide and four

yards high. This return shows many important points; we have the destruction of the crop on one acre where the Grub attack was not attended to; also a trustworthy estimate of the amount of loss to be expected on shortness of crop following attack, and outlay thereon; and we have the thorough recovery based not on chemical or special applications to destroy the Grub, but on the broad principle of supplying extra food to support the plant, and keep it up in heart, whilst suffering (*i. e.*, starving) from more or less of its food supplies being cut off according to the greater or less amount of the stem gnawed by the Grubs. With regard to special experiments made at Mr. Fitton's desire by Mr. A. Smetham, of Liverpool, to ascertain the effect of various chemical applications on these Grubs, he mentions that it was found that a four per cent. solution of carbolic acid in water killed them in one to two minutes, and that in a solution of one part of carbolic acid to 250 of water they were killed in eight minutes. Blue vitriol killed them in about ten minutes; green vitriol in less time; caustic potash and also lime did not seem to affect them much. The strong solution of carbolic acid was experimented with in the field, but it proved useless practically, as on examination the Grubs were found within one inch of the surface of the ground watered with it. In my own experiments with regard to the effects of immersion in pure water, I found that although the Grubs appeared to be dead after remaining immersed for about fifty-eight hours, yet they recovered when they had been for about ten hours exposed to the air; the amount of further endurance of immersion was difficult to ascertain precisely, but the whole period did not exceed about five days and nights, as the Grubs then burst. Immersion in nitrate of soda caused an immediate and violent discharge from the intestines. With regard to the effect of cold, I was kindly permitted to have some specimens frozen at Kew Observatory by artificial means down to a temperature of –10°,—that is to 10° below zero, or 42° of frost, and though almost all the Grubs died under the experiment, yet it showed that exceptionally the Grub could survive even this amount of cold, to all appearance uninjured. Mr. George Brown, jun., Caithness, also mentions instances being known of the "Grub" being frozen until quite brittle, and yet when thawed being as lively as ever.

With regard to salt, Mr. George Brown mentions that he planted a number of Cabbages (all in a thriving state before the Grubs were introduced to them) in flower-pots. Salt was then applied upon three occasions, being increased in quantity until plant-life was destroyed, and on examination the Grub was found at increased depths in the soil, this depth below the surface seeming to be regulated by the amount of salt applied, but all the Grubs were found to be in no way the worse for the application. Mr. Robert Service mentions that he

has placed the "Grubs" in a strong brine for twenty-four hours, and that it has not killed them. Shortness of food also does not affect the Grubs rapidly, as Mr. Fitton mentions that he placed some of them in a glass globe with a little soil, but no plant-food, and three weeks after they appeared all right. The thing that the Grubs really cannot bear (as far as the experiments noted show for practical purposes) is drought. Of the large number sent me by post, I could rarely find enough alive for the experiments I wished to undertake, and I ascribe their condition to want of moist surroundings. Mr. Robert Service mentions that at Maxwelltown this "Leather Coat Grub" is as a rule the most damaging pest of the neighbourhood, but that this year, in which a dry cold spring followed in that locality on a fine winter, he did not see a field either of Grass or Corn affected to any extent.

Mr. Loney, writing from Marchmont, Berwickshire, not far distant in geographical position from that of the above observation, also notes only a slight attack. A few patches of Oats were attacked during May, especially on soil that was not in a good state of cultivation, and he strongly advises deep winter ploughing as a preventive against the Grub. This is noticed by Mr. Malcolm Dunn as being less destructive than usual at Dalkeith during the past season. The same traps as are used for the Wireworm are also effective in catching the Grub of the "Daddy Longlegs." When the Cabbage tribe are planted in ground infested by the Grub, they should have their roots and stems up to the leaves well smeared in a thick mixture of clay, nightsoil, and ammoniacal liquor (from gasworks), or some other equally nauseous compound, which the Grub does not care to attack. The stem of the plants is the part usually attacked just under the surface of the ground, and it is a good plan when the Grub is observed to be active to draw back the soil around the stem to a depth of a couple of inches, and put a ring of lime, soot, or even rotten manure round the stem of each plant, which will generally prevent the Grub attacking it. Mr. Dunn notes that the Spotted Crane Fly, *Tipula maculosa*, was scarcely seen, and not any serious damage done by it. The same appliances as for the "Daddy Longlegs" Grub are used to destroy it, but it is rather more difficult to kill.

Mr. Anderson mentions that the Grubs were found to be very destructive amongst Strawberries at Oxenford Castle, Dalkeith, as many as from seven to twelve being found at the root of one plant just beneath the surface. Hand-picking was the only remedy resorted to, which, as Mr. Anderson justly remarks, "is both expensive and repulsive." Mr. Whitton mentions that at Coltness, Lanarkshire, there was a strong attack of *Tipula oleracea*, locally known as "the Grub;" he notes that he never saw anything like it before for quantity, but that the damage done was not as great as might have

been expected. These Grubs were noticed in moving Sedums in the garden, and as many as possible were killed with the spades; the beds were left for a day or two, and then forked over lightly again. This disturbance caused the Grubs to move on to the walks (which are made of asphalte) at the same time the lawns were being rolled, and in the morning the Grubs were on the walks by hundreds. All trouble in destroying them was saved by starlings and tame ducks from a small pond in the grounds, and the lawns were thus saved. In the kitchen garden the Grubs did much harm both to the Strawberry plants and to the Cabbages. Mr. Whitton mentions that he tried carbolic acid and ammoniacal liquor from the gasworks, and hopes to succeed in future by applying them at night when the Grubs are on the surface, and it might be expected to kill them as it did those on a hard walk. Mr. Whitton also notes relatively to the field crops that a sowing of good guano on the first appearance of the Grub, if done in showery weather, is considered a good remedy.

Mr. D. Scott mentions that at Darnaway Castle, Morayshire, a considerable number of Grubs were noticed in a crop, partly Potatoes partly Oats, following on old lea, but that no perceptible injury was caused, and he adds, "I think the rooks must have done good work in the way of destroying them; they were for a time continually in the field, and had apparently turned and returned every clod." Mr. Robert Coupar notices the *Tipula oleracea* as very numerous at Craighall, Perthshire, and that the Fly was to be seen in enormous quantities by the roadsides at night. He mentions the *Tipula maculosa* as not so common. Mr. M'Donald, writing from Balfour Castle, Orkney, says, "Never have we experienced in Orkney a drier, warmer, or sunnier season than this of 1880, but never has the Grub of the *Tipula oleracea* been more destructive." He suggests that the early warmth acted on unhatched eggs, and, together with an early and luxuriant vegetable growth following on the previous ungenial seasons, promoted a rapid development of larvæ, resulting "in such myriads of Daddy Longlegs as I never before saw." In the Isle of Man these Grubs were also troublesome. On the 5th of May Mr. Edwin Birchall forwarded specimens, with a note that these larvæ, locally known as "Cutworms," were ravaging the Oat fields. Salt was not found destructive to them, and Mr. Birchall notes that the chief manure used in the island is seaweed. He also draws attention to the great amount of benefit we have from the lapwings clearing off this pest, and the desirableness of these birds being protected from the wholesale destruction of which he gives notes. Mr. Mosley of Huddersfield, draws attention to the large number of Crane Flies, which from personal observation of rooks in some badly infested Grass fields he found were rapidly cleared by these birds.

6. Anthomyia ceparum. Onion Maggot.

Mr. Melville observes, writing from Dunrobin, Sutherlandshire, that this year's experience has much strengthened his opinions as to the best way to avoid attack of this Fly. (See Report for 1879, p. 12.)

Mr. Alexander Forbes mentions that an excellent crop of Onions entirely free from Maggot was harvested at Skibo Castle, Sutherlandshire; and Mr. Fitch did not observe any attack at Maldon, Essex; but in many localities the Maggot was very destructive. The most successful remedy for the attack, when found to be established, appears to be in the use of paraffin oil; and I place consecutively the descriptions of treatment that include methods of application of this cure.

Mr. M'Kinlay, writing from Tulloch Castle, Ross-shire, mentions that in many parts of Ross-shire the Onion crop suffered much from the Maggot, and in some gardens it was a complete failure, the summer being dry and apparently suitable to the Onion Fly. The only means found serviceable for prevention was the use of sand saturated with paraffin oil, and sown amongst the Onions, and this afterwards watered by means of a can with a rose. Mr. M'Kinlay experimented on the direct effect of the paraffin by placing some Onion Maggots in a flower-pot in soil with some young Onions. On the third day (thus giving time for the Onions and their contents to be re-established) he introduced three drops of paraffin into the flower-pot; and on examination with a magnifying-glass, twenty-four hours afterwards, all the Maggots, with the exception of two, were dead. Lime water was not so effectual, but proved fatal after a time. In the gardens at Tulloch Castle the crop was excellent. The method of cultivation is to trench the Onion ground early in autumn, working in plenty of manure, and leaving the surface rough to be pulverised by frost. About the 10th of March, if the weather is favourable, about six or seven cart loads of hen-manure are wheeled on to the Onion break previous to forking (care is taken to have the hen-manure well turned during the winter, and covered with soil to keep in the ammonia). After forking, the ground is well raked, the seed sown in rows a foot apart, and after it is covered the soil is well trodden with the feet and raked over. The trampling of the feet makes it quite hard, and is considered to do good by preventing progress of the Maggot.* Mr. Wilkie mentions the Onion Maggot as having done considerable damage at Ardkinglas, Argyllshire; but that after mixing a good glassful of paraffin oil with about six gallons of water

* The power of the Maggot to travel from one bulb to another deserves more consideration than is usually given to it. This point is not mentioned, as far as I am aware, in the life-histories; but from my own observations I believe the Onion Grub has full power if food runs short in one spot to remove to a neighbouring bulb.—Ed.

and carefully throwing a spray of the mixture over the Onion bed two or three times, the attack was terminated. At Langwell, Caithness, Mr. Sutherland notes that the ground is ridged for the Onions so as to expose it as much as possible to the frost; and horse manure is thought to be the best (if not too much fermented) for use on heavy damp soils. Here the Maggot was very troublesome this season, and when it appears paraffin is mixed with water in the proportion of a pint (English measure) to two gallons of water, and with this the Onions that are planted in rows are watered through the spout of the can without the rose; those that are in beds are watered with the rose on the can. Mr. Sutherland observes that the paraffin should be used carefully in dry weather, lest it should burn the plants.

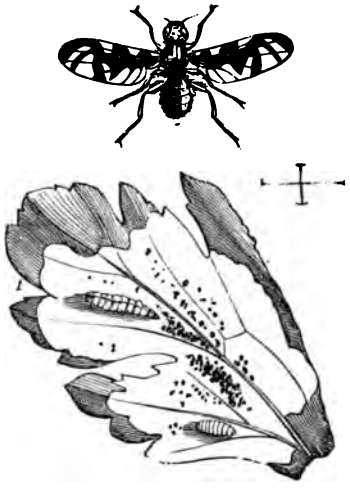
Mr. Simpson mentions that the principal part of the Onion crop at Brahan Castle, Dingwall, was not injured; but a few lines of Welsh Onions, sown in a part of the same break, were spoiled by the Maggot, conjecturally in consequence of the different treatment of this part of the ground. The ground for the principal part of the crop was trenched and manured at the end of the previous year, and soot and wood ashes were spread on the surface before levelling for seed-sowing on the 11th of March. Mr. Boyd observes that he noticed many of the Onions in the gardens at Callander Park, Falkirkshire, at the beginning of May to be turning yellow at the tips of the leaves, and on pulling them up found nothing but a tube full of Maggots. He at once put on a woman to pick every Onion so affected and burn them; and the result was as fine a crop of Onions as could be desired. Mr. F. Grant Findlay mentions that at Castlemilk, Locherbie, Dumfriesshire, the damage from Onion Maggot is usually trifling; this year, however, it amounted to fully one-eighth of the crop. Mr. Findlay finds its presence less observable when the ground is well prepared previous to sowing the seed. He generally trenches deep in November, and lays in a liberal supply of well-decayed stable and cow manure; and the natural soil being stiff and heavy is greatly improved by exposure to the air; therefore it is put up in ridges, which remain until the latter end of February, when they are levelled with forks. On the first favourable day in March the ground is well trodden, the seed is sown in drills, and before the drills are closed a compost is sown broadcast and pretty thickly over the ground, formed as follows: —four parts of refuse soil from the potting bench, two parts dry soot, and two parts wood ashes; these are thoroughly mixed together and put through a fine sieve before being used. This system usually produces good crops of excellent quality, and with little amount of insect attack.

At Torloisk, in the Isle of Mull, Mr. Grierson notes that the Onion Maggot began its attack about the 1st of June, and by the end of July

there was not a single Onion on the break of about eighty square yards. The ground had been rather wet, so it had been drained in winter and trenched about two feet deep, and a good layer of farmyard manure placed at the bottom of the trench. In the spring, a few days before sowing, a compost was made of soot, sea sand, pigeon manure, and lime rubbish; a good coating of this was given all over the land, and it was forked in. Several dustings with soot were given when the Onions were above ground, but the whole crop, nevertheless, was lost. The Maggot is also reported by Mr. Russell as having been very destructive at Poltallock, Lochgilphead, Argyllshire. Mr. Russell considers that in the light soil of that neighbourhood the Onions do best on ground not trenched, and he gives two dressings of guano—one when the plants are about four inches high, one later on. The Onion Maggot is noticed by Mr. Whitton as worse this year than usual at Coltness, Lanarkshire. The beds were dressed at the time of sowing with Annis's chemical manure as a preventive; on the first appearance of the Grub another dressing was given, but it failed on this occasion, though previously it had been found of use in checking the Maggot. Mr. Robert Coupar, writing from Craighall, Perthshire, mentions the Onions throughout that part of the country as being everywhere more or less damaged, and the Onion crop almost a failure.

Mr. M'Laren notes that at Hopetoun, South Queensferry, he has found a solution of alum in water a good and cheap remedy for the "Worm" in Onions. The Onion Fly was not so plentiful as usual in the district of Dalkeith, the past season being good for the Onion crop. Mr. Malcolm Dunn mentions—"Autumn manuring with rich and well-made manure, deep cultivation, and change of ground every season, secure us first-rate crops, almost entirely free from 'Maggot.' The soil is put up in ridges when trenched, or double dug in autumn, the ridges levelled with forks early in March, the surface firml trodden, raked, and drilled about a foot apart, and the seed sown. When the plants are about six inches high, they are thinned from three to five inches apart, according to the size they grow, and receive a dressing of dry soot on a damp morning. Keeping clean of weeds is all that they require afterwards till the crop is ready for lifting." Mr. P. Loney, writing from Marchmont, Berwickshire, mentions that he has no trouble with the Maggot, as "on its first appearance I water freely with soap-suds two or three times, which usually destroys it, and nourishes the Onions." In some localities the crop was entirely swept away, or was much injured. Mr. Robert Service, writing from Dumfries, mentions the attack of Maggot "never was worse than it was in this district during July; I do not think there was a single bed of Onions unaffected by it." At Sparham, near

Norwich, and at Little Ilford, Essex, the Onions suffered much from the Maggot, and the Onion bed in my own garden near Isleworth was the most complete failure I ever met with. I attribute this in part to the ground, which is a stiff loam, not being sufficiently cultivated and manured beforehand; also, I feel doubts as to the desirableness of guano as a stimulant. Being anxious to experiment on the matter, I applied it liberally as a watering, or occasionally as a dry sprinkling along the rows, washed in by watering; and following on this the attack commenced, and was excessively severe.

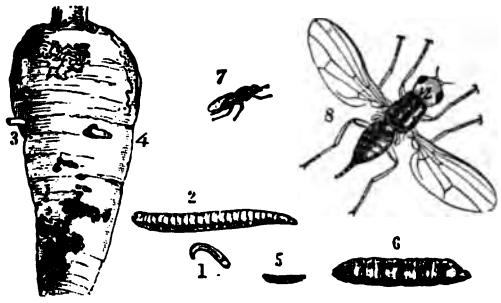


TEPHRITIS ONOPORDINIS.

8. Tephritis Onopordinis. Celery Fly. The worst attack observed of this Fly was reported by Mr. Glenny, who forwarded specimens of injured leaves from Barking, Essex, on the 16th of September. On the first signs of insect presence the infested portions had been picked off, and it was hoped further damage had been prevented, but about the beginning of September a new attack took place, and the Celery was spoilt for the year. At New Malden, Surrey, Mr. J. Dobson, jun., notes that the larvæ were very plentiful in the same situation as last season, and that pinching the Grubs in the leaves, which was then tried, proved of little use as a remedy. This year he had each plant examined when transplanting, and all pieces infested by Maggot snipped out with a pair of scissors. Another examination was made three weeks later, accompanied by a similar trimming, and the Celery growth was pressed on by good treatment. The result was "a better crop could not be wished for." In my garden near Isleworth (in which neighbourhood the Celery

often suffers very severely), I had the trenches prepared with plenty of rich manure from a butcher's yard, and covered over with earth about three weeks before the plants were moved to them. I allowed the young plants, which had been pricked into a bed in the usual way, to grow rather larger than is customary before moving, and then had each one taken up by the trowel, and moved with as little disturbance as possible; thus they did not flag at all, and no attack followed the removal. To keep off the Fly, I used a dressing of one part of gas-lime (about a month from the works), one of unslaked lime, and two of mixed dry earth and soot, all well stirred together, and dusted liberally on the plants, so as to lie on the leafage and lightly cover the ground. This did not injure the leafage in the slightest perceptible degree, and beyond a few stray injuries I had no attack from the Celery Fly. Looking at the point of Celery being a plant naturally growing in wet spots, I occasionally had the hose turned on one of the trenches, so as to soak the ground thoroughly, and the effect was excellent on the growth. Also by this means the leaves may be well cleared of insect vermin. If the hose is directed at the foliage when a good power is on from the water-works, and taken steadily on from one end of the row to the other, the stream will be preceded by a gradually increasing collection of small Flies driven from the plants, which thus are freed from some amount of attack, and are cleared of the insect vermin at least for a while.

Mr. Freestone notes that the Celery at the Manor Park, Little Ilford, Essex, was very promising until early in August, when the Maggot destroyed the whole of the foliage; a worse attack than had been observed in ten years' experience. A similarly severe attack of the same species of insect (the *Tephritis Onopordinis*, or Celery and Parsnip Leaf-miner), occurred at the same time to the Parsnip crop, nearly all the foliage being destroyed. The six weeks' drought in July and August is noted as apparently favourable to these pests. The Celery is reported as unusually free from the Maggot. Little is noted concerning it from northernly localities. Mr. Simpson notes from Brahan Castle, Dingwall, that it is "never seen in this quarter." Mr. Loney also mentions it as never observed at Marchmont, Berwickshire; and Mr. A. Shearer notices the Celery as not being much attacked at Yester, East Lothian. A rather sharp attack is mentioned by Mr. Malcolm Dunn as observed at Dalkeith about the middle of August, the Maggot appearing at the same time in the leaves of both Celery and Parsnips; however, it made little progress, and soon disappeared. The usual remedy is noted to be hand-picking, as soon as the spots with the Maggot are noticed on the leaves.



PSILA ROSÆ.
Carrot Fly, larva and pupa natural size and magnified.

9. Psila Rosæ. Carrot Fly. The following observations give details of methods of treatment found most successful in pushing on healthy growth, with notes of the use of special applications, as wood-ashes, soot, gas-lime, soap-suds, &c., and also of the use of paraffin; attention is also drawn to the importance of keeping up an unchecked growth, and especially of the danger of attack from the Fly penetrating down into the ground to lay its eggs in the Carrots when disturbed by thinning. I endeavour to give the observations in such order as may place the notes referring to any special applications or methods of treatment together, and the first include details of application of paraffin. Mr. Alexander Anderson mentions that he has grown the early French Horn Carrot for the last four years at Oxenford Castle, Dalkeith, on a bed of tree-leaves covered with soil composed of the emptyings of flower-pots, boxes, &c., and consequently of a light friable texture. The size of the bed is fifty feet square, which is sub-divided into four feet beds, and is sown broadcast. The crops have proved clean and good, with the exception of last year (1879), when they were an entire failure. On the 19th of April in this year, 1880, Mr. Anderson had the soil dug over, and the ground again sown with Carrot seed, and in order to experiment, after the seed was sown, the beds were beaten quite firm, and lightly covered with soil as above-mentioned. A good dressing was then given with wood-ashes, in which paraffin oil had been mixed in the proportion of one quart to a barrow load of ashes—about one cwt. When the plants were about four inches high, a second dressing of the same mixture was given, and Mr. Anderson says he can state that he never lifted a better crop of Carrots. In other parts of the garden, where they were dressed with wood-ashes alone, the Carrots were badly affected. Mr. Anderson mentions that he thinks that mixing the paraffin with some absorbing substance is better than simply watering with a solution of it, as it lasts longer,

and is more gradually carried down into the soil. He mentions also that he never thins the Carrots until they are fit for use, as unless it is done very early there is great danger of leaving broken roots in the ground, and thereby encouraging the Grub.

Mr. M'Laren notes that the Carrot crop in the garden at Hopetoun, South Queensferry, was lost for several years until paraffin oil, in the proportion of two wine glasses to a gallon of water, was run along the drill as soon as the Carrots were thinned. This proved very successful, but Mr. M'Laren considers that a solution of alum in water applied by a watering-can with a rose is still more effectual, and also saves some risk of misapplication of the paraffin. Gas-lime is also mentioned as a cure for the Carrot Worm, dug two or three inches deep into the bed before sowing. Mr. Malcolm Dunn, writing from Dalkeith, notes the Carrot Fly as "an annual pest in this district, but scarcely so bad as usual during the past season." Remedies have been given in former reports. Perhaps the most effective is a dressing of gas-lime forked into the soil before sowing, or an application of ammoniacal liquor or strong manure water whenever the Fly is first noticed on the wing. Mr. Alexander Forbes, of Skibo, mentions that in an experience of twenty years he has found more difficulty in securing good clean Carrots than any other crop, and that though he is seldom free from the Fly entirely, yet he has never had a complete failure since adopting the following course:—Before hard frost sets in he has ground double dug, putting manure at the bottom of the trench, and when this is complete gives a good dressing of salt, which is washed down before spring, and previous to sowing a good dressing of soot and wood-ashes is forked into the soil. He is careful to perform the first thinning as soon as the plants can be handled, leaving them an inch or two apart. When the thinning is finished he gives a sprinkling of guano, and if dry a thorough watering, and he particularly draws attention to the great importance of running on a healthy growth. He observes, "We hold it of the utmost importance to keep them growing without a check till some time after they are finally thinned, when, if all has gone well, the crop may be considered secure, but it will be well, however, to look them over occasionally, and if any be found to droop, they had better be pulled up and burned."

Mr. Grierson's treatment of his Carrots at Torloisk was quite successful. The ground (as with that for Onions) was drained in the previous winter, trenched about two feet deep, and a good layer of farm manure placed in the bottom of the trench. In the spring the ground was prepared in the usual way, but before sowing the seed Mr. Grierson had deep holes made about eight inches apart, and filled with a compost of old soil from the potting shed, soot, sea sand, wood-

ashes, pigeon manure, and lime rubbish; and a few seeds were placed in each hole. The result was a splendid crop of beautiful clean Carrots. A few lines were tried without the holes, and with a little of the compost placed beneath the seeds, but every one was destroyed by the Carrot Grub. Mr. John Sutherland notes that at Langwell, Berridale, the ground is turned as rough as it can be laid in winter, and a good dressing of salt is given. In spring it is forked over with a steel grape, and a dressing given of peat and ashes, and the lines sown a foot apart. When the Carrots are thinned, a mixture of soot and water is poured on them, and paraffin is also used as a watering. One English pint of paraffin to two gallons of water is the proportion which Mr. Sutherland has found serviceable in garden watering, with care in application, especially in dry hot weather, lest the paraffin should burn the plants. Mr. Melville, writing from Dunrobin, Sutherlandshire, mentions that he is confirmed in his views of the treatment advised last year (see Report for 1879, pp. 14, 15), in which, with some notes as to preparation of the ground, he particularly recommends that any thinning that is necessary should be done whilst the Carrots are an inch or two high, and in wet weather.

Mr. M'Kinlay notes that at Tulloch Castle, Dingwall, the soil is not suitable for Carrots, being of a damp heavy clay, and it has consequently been found desirable to prepare a special piece of ground where the Carrots are grown year after year. The soil was removed to the depth of two feet, and replaced by a mixture of well-decayed leaf-mould, sand, charcoal, soot, and light soil; this mixture is found to grow Carrots very well. The Carrots on this ground were little attacked by the Fly, though some in the neighbourhood suffered severely. In one locality it was found a good treatment to put short Grass between the rows to prevent the drought going down. Paraffin, as recommended for Onions, is also noticed as useful. It is noted as desirable that Carrots should be thinned at the first weeding to the distance at which they are to be grown in summer; as when Carrots are thinned, after they come to any size, the soil is opened around them, and if dry weather follows the Fly is sure to attack them. Mr. Simpson notices the Carrot Fly as very destructive this year at Brahan Castle, Dingwall. He says "I am in the habit of sowing thin, and not thinning the Carrots till fit for use." This season, after they commenced thinning the second sowing of early Carrots, "the Grub commenced too, and within three weeks spoiled them for use. Late ones alongside escaped until we began to use them, and by keeping to the side the 'Grub' was on it kept up, but did not advance beyond the thinning." Neither lime nor soot had any effect, though dusted over the ground. Mr. F. Grant Findlay, writing from Castle Milk, Lockerbie, mentions that the Fly has been unusually troublesome this

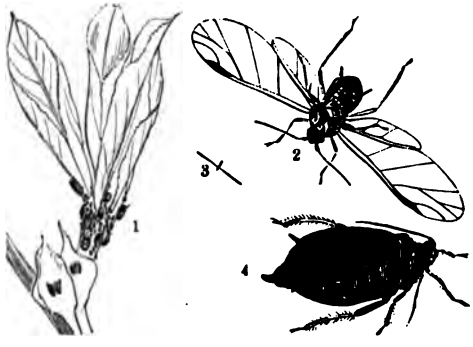
year. He observes that, having hitherto failed to discover any effectual remedy, he determined to try the effect of a change of soil, and accordingly in January had a portion of a break in vegetable cropping ground cleared out to the depth of twenty-two inches. This vacancy was filled in afterwards with a compost of four parts good brown peat, four parts light fine yellow loam from old Vinery border, two parts well-decayed leaf-mould, and two parts river sand, the whole being thoroughly mixed together; no manure of any description was used. The Carrot seeds were thinly sown on the 6th of April in drills fourteen inches apart. They soon germinated, grew rapidly, the thinning was done in the latter part of May, and all went on well until the 17th of June, when the Fly was observed to have begun its ravages, and in less than fourteen days the whole crop was rendered useless. In another part of the garden a hotbed of stable manure was made up, and on the surface of this bed a layer of well-decayed leaf-mould was laid to the depth of ten inches. In it the Carrot seeds were sown on the 13th of February, and an excellent crop was obtained from the beginning of May. Here the Fly did not make its appearance until the 27th of July, the remainder of this crop being destroyed by its ravages by the 12th of August.

Mr. T. Boyd mentions that being troubled with the Carrot Grub at Callendar he customarily sows on two or three pieces of ground. During last winter he gave one piece of ground intended for Carrots a top dressing of gas-lime, and not one carrot on this ground went; whilst on the other piece, to which nothing had been applied, the whole crop went before the last week in April. His method is to rough dig the ground at the beginning of winter, then sprinkle the gas-lime over the ground "till it resembles a fall of snow;" then point it in about four inches. Mr. P. Loney, writing from Marchmont, Berwickshire, observes, "I very seldom have a visit from this Fly:" deep trenching after Celery, cropping with Onions and with Carrots without manure, is the system I adopt; whilst the slightest deviation, especially on land recently manured, is sure to produce them. Mr. Service, writing from Maxwelltown, mentions the crop of Carrots being reported as saved in a cottage garden "by deluging them with the soap-suds left from the washing;" and he observes that during 1880 the garden crops were very badly attacked as usual, and field crops again almost untouched. Mr. T. M'Donald mentions that the Carrot Fly was very injurious this season on the same ground that was used last year; and observes that the Altringham was much helped by frequent watering with salt water.

Mr. D. Sym Scott reports that at Ballinacourte, Tipperary, the Grub of this Fly appeared about the 1st of July, and he observed that the attack was most severe in the centre of the field, on a portion of

ground which did not receive the same treatment as the rest with regard to manuring, and where consequently the plant was more feeble than on either side. He considers that bad manure and the want of having applied salt were the cause of the attack, and recommends that good manure, rich and well rotted, be ploughed in at the autumn ploughing, and artificial manure with salt be applied in the drill at sowing time. With regard to prevention Mr. Sym Scott notes, "I kept some women pulling out every plant as it showed symptom of the Worm and had them removed from the field, which I believe was a great means of saving part of the crop." This Grub is noted on the 15th of July as taking Carrots in small patches at Tangley, Guildford; soot and paraffin were applied, and the Carrots afterwards showed very good roots at the spots where this dressing was given, which had been the worst points of the attack.

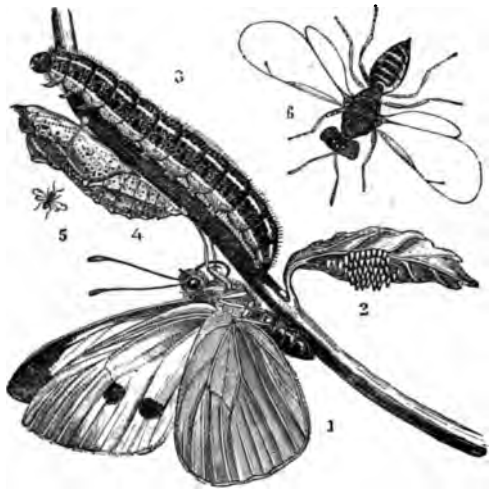
In my garden at Dunster Lodge, near Isleworth, where the Carrots are subject to attack from this Fly, I had a small plot prepared in the spring by digging the soil entirely out to the depth of eighteen inches. This space was filled in again with a mixture of about one-third leaf-mould of decayed Elm leaves, one-third of the loam that had been dug out, and another third composed of coal-ashes, broken peat, and a little white sand, well mixed together. The Carrots were sown on the 12th of March, and did very well till the end of June, when they were thinned, and very shortly the Grub appeared amongst those most disturbed by thinning. I watered them well with dilute soluble phenyle, and further on repeated the application in still more dilute form, pouring it over the leaves, and then giving a good washing with pure water. The Fly attack was stopped, and the Carrots grew vigorously.



APHIS RUMICIS.
1, Bean-shoot, with Aphides; 2, male; 4, female (both magnified).

10. Aphis rumicis. Bean Aphis; Collier. This was very bad in some parts near Dalkeith during the hot weather of July and August.

Topping the shoots, taking off the infested parts, and destroying the insects is mentioned by Mr. Dunn as the speediest and most effective remedy; it ought to be done at once, on the first appearance of the Aphis, to prevent it spreading. Mr. E. A. Fitch mentions that on the 7th of July he noticed one of his fields of Beans nine acres in extent, at Maldon, covered with "Collier." The tops of the Beans of about six acres were cut off with brushing hooks by men walking along the stetch furrows, but the attack went off as suddenly as it appeared; no difference was noticeable in its amount between the six acres cut back and the three not meddled with, but it is not mentioned whether the cut tops with "Colliers" on them were removed. The first observation of the attack was on a day of much rainfall, which proved to be of some days' duration, and presumably cleared the Aphides. Mr. James Long, of Old Field, Henlow, Herts, mentions the appearance of the Collier on his ground early in July, and much damage threatened; saved, however, by the violent rains, which cleared the plant-lice, and invigorated the growth of the crop.



PIERIS BRASSICÆ.

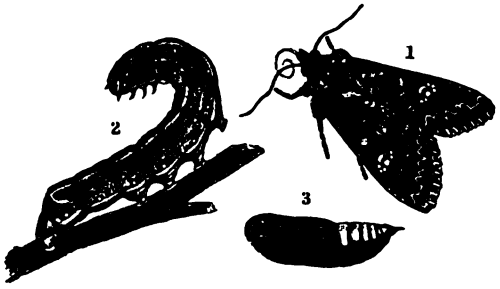
Large White Cabbage Butterfly, eggs, larva, and pupa. Parasite Fly, *Pteromalus brassicæ*, natural size and magnified.

11. Pieris brassicæ. Cabbage Butterfly. Mr. M'Kinlay observes that after the dry weather set in the Cabbage Butterfly was to be seen in large numbers in gardens near Dingwall, and proved very destructive. The remedy (recommended by Mr. Malcolm Dunn in the Report for 1879) of giving a sprinkling of fine salt was found serviceable, as also the simple plan of laying some branches of Broom

on the Cabbages which were most infested. This is found to act well as a preservative from attack. The Cabbage Butterflies are also mentioned by Mr. Russell as very numerous, and the Caterpillars as destructive this year (especially in cottage gardens) at Lochgilphead, Argyllshire; but Blackbirds, Thrushes, and small birds are noted as numerous, and as doing good service in keeping down attack. In the Isle of Mull the Large White was not nearly so plentiful as during last season. At Callander, Falkirk, it is noted as almost entirely absent; and at Oxenford Castle, Mid Lothian, not a single specimen was seen. Mr. Malcolm Dunn notices the Cabbage Butterfly as not numerous at Dalkeith till the autumn, when the Caterpillars appeared in considerable numbers, and ate up the Savoys and Cabbages in some gardens. It is noted that the Caterpillars may be killed by a dusting of caustic lime, or a watering with weak brine, lime-water, or soap-suds. The Small White is mentioned by Miss Birchall as doing some amount of damage at Douglas, in the Isle of Man; and this species is also mentioned by Mr. Brunton as very plentiful at Glenarm, Co. Antrim, Ireland, in August and September. Mr. Willoughby Gardner notices the very early appearance of the *Pieridæ* at Conway, fresh specimens of the Small White being out on March 26th; and Mr. Bairstow, writing from New Brighton on the same day, mentions the Cabbage White as occurring in numbers along the rocky slope of a mountain about half a mile from Llandudno Junction, where the caves and openings in the mountain make the locality peculiarly favourable for their habitation and recreation-ground.

Mr. Edw. Parfitt observed the first "Small White" on the 27th of March, the second on the 29th, at Exeter, these being fresh specimens, and he mentions that the Small Whites were more numerous in the spring than he had ever observed them before. Mr. D'Urban also mentions the Small White as appearing in greater numbers than he had ever before noticed them, and as extremely destructive to Cabbages about Exeter in August and September. The Savoy and other Cabbages were reduced to mere skeletons, and hand-picking was resorted to. Mr. H. J. Dobson notes the Butterflies of the Large and Small Whites as very plentiful, flying everywhere at New Malden, Surrey, during the dry weather of May, and that they were plentiful in all stages at the end of August, which was a warm month, with little rainfall after the first six days. The Caterpillars of the Small White are noticed by Mr. Hart as having been plentiful on Cabbage of all kinds and on Swedes, at Kingsnorth, Kent. Mr. Charles Foran mentions the *P. rapæ* as first seen at Eastbourne, Sussex, on the 13th of March, and the *P. brassicæ* on the 20th of April, neither of the species being more numerous than in ordinary years. Mr. Fitch notes that at Maldon, Essex, his Cabbages were "far from improved

by *P. rapæ* larvæ in August;" and the Cabbage Butterfly is mentioned as troublesome at the Manor Park, Little Ilford, Essex, in July and August, when the Caterpillars literally riddled the crop, but disappeared after a few cold nights about the first week in September. They were very destructive at Sedbury Park, West Gloucestershire, from August to October, and at Little Faringdon they became plentiful after August 15th. The Butterflies of the Large White were exceedingly abundant at Warminster, Wilts, in June and July.



MAMESTRA BRASSICÆ.
Cabbage Moth, larva and pupa.

12. Mamestra brassicæ. Cabbage Moth. Mr. Hart notices that the Caterpillars have done much mischief to the autumn Cabbage and Savoys, eating their way into the Cabbage to such an extent that it is to be feared as winter sets in more Cabbage will rot than will be eaten. The Caterpillars are also mentioned by Mr. D'Urban at Exeter as very plentiful from June to September on almost everything. Miss Birchall, writing from Douglas, Isle of Man, notices the Caterpillar as stripping the plants of Beet in the garden, apparently preferring it to other food. At Brahan Castle, Dingwall, Mr. Simpson notices the Caterpillar as troublesome to late planted Cabbage, and that on the 28th of October they were quite lively, and feeding inside the recurved leaves, although ice was then covering the outer leaves of the Cabbages. Mr. Malcolm Dunn notes that this Moth appeared rather numerously at Dalkeith, and especially in weedy and neglected gardens, or those surrounded with hedges full of weeds, amidst which the Moth harbours, and, as the Caterpillar is very difficult to deal with in the hearted Cabbage and Savoys, he draws attention to the importance of stamping out the Moth, and destroying its places of refuge amongst weeds in waste and neglected places.

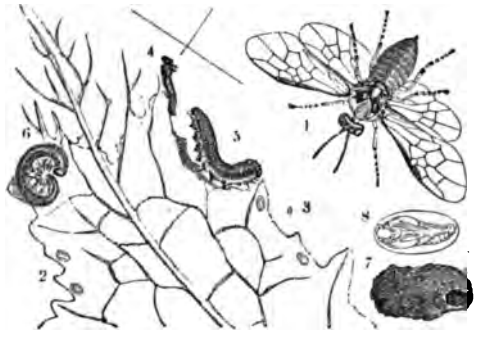
Mr. Wilkie mentions the Caterpillars as not prevalent at Ardkinglas, Argyllshire, although common in June, and that hand-picking is the general means used for their destruction. At Poltallock, in Argyllshire, Mr. Russell mentions that the Caterpillars were injurious,

and a dressing of soot and lime was found beneficial for keeping them in check. In my own garden, near Isleworth, I found great benefit from sprinkling the Cabbages with gas-lime from a heap that had lain for about four months exposed to atmospheric action. The weight of the finely crumbled material carried it down, and lodged it in the crannies of the hearted Cabbages, and made any traffic about the Cabbage so unpleasant to the Caterpillars as apparently to check any attack from additional ones crawling up the stem. I also sprinkled it liberally round the Cabbages, and, though it was not in all cases a complete preventive, it did much good. The gas-lime at this stage of exposure to the air in no way injured the leafage, and it acted well as a preventive of attack from Slugs as well as Caterpillars.

13. Agrotis segetum. Turnip Moth. Common Dart Moth. Scarcely noticed.

14. Phyllotreta undulata. Turnip Fly. Mr. Malcolm Dunn, Dalkeith, mentions that the practice of using the water-cart for watering Turnips affected by the Fly has been common in the Lothians for a good many years, wherever water is conveniently attainable. During the present season (1880) he had seen several water-carts in use where the Turnip Fly was troublesome, and the ground hard and dry. In the case of a field of Turnips about two miles east of Edinburgh, that would not start till the water-cart was resorted to, the Turnips were afterwards as fine as any in the district. Mr. A. Shearer notes that at Yester, East Lothian, the Turnip Fly did little or no harm this year. June was a dry month, but nearly five inches of rain fell in July, this being much above the average rainfall. At Marchmont, Berwickshire, Mr. Loney mentions the Turnip Fly as scarce, and since the rains of September the Turnip crop increased immensely in value. Mr. Service mentions that the Fly occurred at Maxwelltown, Dumfries, during the first ten days of June, but in few instances to any injurious extent. The beginning of June was dry, and rain coming on was unfavourable to the increase of the Fly. Mr. Service observes that guano is sometimes applied in the district, with a view of forcing on the plants beyond the reach of the Fly. Turnip Fly is mentioned by Mr. Simpson as having proved very troublesome on some farms near Dingwall, Ross-shire, especially along the sheltered sides of the fields. Re-sowing was contemplated in some cases, when showery weather set in and saved the plants, at the same time that it cleared the Fly. At Poltallock, in Argyllshire, the Turnip Fly is noted by Mr. Russell as rather destructive amongst the first and second sowing of Turnips, and a dusting of lime and soot is noted as having been found serviceable in destroying the insects. The Fly is

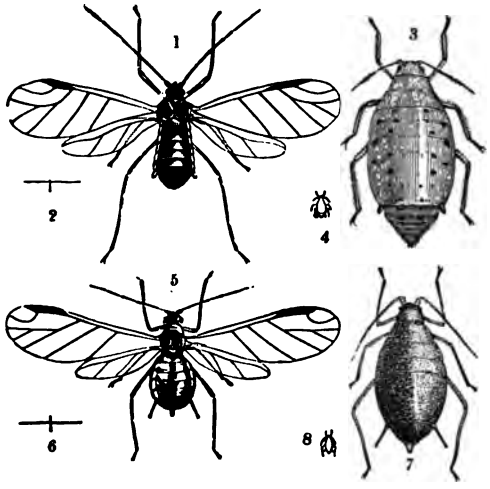
reported by Mr. Grierson as very prevalent in the Isle of Mull, where several patches had to be re-sown. The failure was ascribed to the dry weather. A slight attack of Fly is reported by Mr. Brunton as occurring at Glenarm, Co. Antrim, Ireland. At Guildford; at Maldon; and at Exeter the absence of Fly is noted. Mr. Long mentions that at Henlow, Herts, the Turnip Fly has not been injurious this season, and that it hardly ever is so when the soil is thoroughly moistened. Mr. Wailes, writing from Beacon Banks, Easingfold, Yorkshire, mentions that Fly is caught by wheeling a board (to cover two rows) painted with treacle or some similarly sticky substance, so that the Fly leaping from the leaves on disturbance adheres to the surface, and is killed. Mr. Wailes also draws attention to the importance of the plant being pushed into vigour by good manuring, and notes that the Fly does not thrive in blowy, rainy weather.



ATHALIA SPINARUM.
Sawfly, larva and pupa.

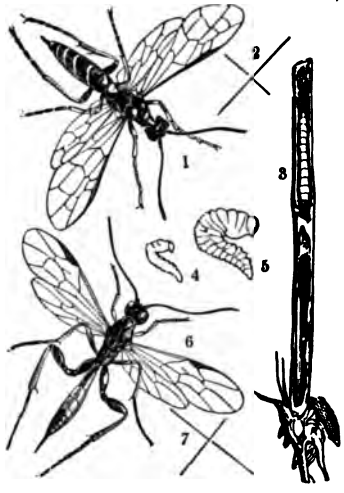
15. Athalia spinarum. Turnip Sawfly; Niggers; Black Palmer. Mr. Service notes that this is rarely injurious in the neighbourhood of Maxwelltown, but that he has often met with the insect when collecting, and has met with it during this summer as usual. Dusting with caustic-lime is mentioned as a good remedy by Mr. Dunn. Mr. Hart notes that he has used sheep and lambs with good effect in an attack of "Niggers" on Turnips in August. About 100 of them were driven backwards and forwards for an hour three days in succession, which quite cleared the plants, and did no injury to the animals. This attack is noted by Mr. Hart as the only one he ever had to deal with, and he tried several recommendations before resorting to the "droving," but they were all useless.

16. Aphis rapæ. Turnip Aphis. Mr. Malcolm Dunn notes that this was rather plentiful at Dalkeith in dry weather, but soon disappeared.



APHIS RAPÆ.

1—4. Turnip-flower Aphis, *A. floris-rapæ*. 5—8. Turnip-leaf Aphis, *A. rapæ*.

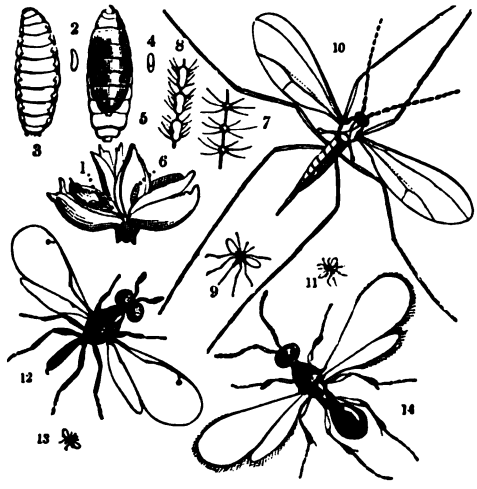


CEPHUS PYGMÆUS.

1—5. Corn Sawfly and larva, natural size and magnified, and infested Corn-stalk.
6. Ichneumon Fly, natural size and magnified.

17. Cephus pygmæus. Corn Sawfly. As the insect occurs in this country, and is seriously hurtful to Corn crops on the Continent, it is desirable to draw attention to it, but hitherto it has hardly been recorded by any of the observers, and though numerous in two localities during this season, it has not caused much mischief. It

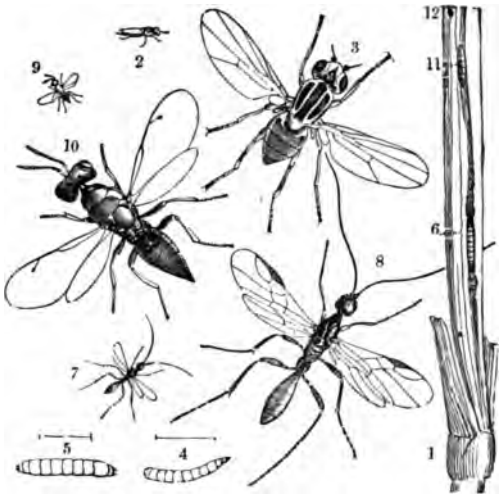
will be of interest to notice whether it appears again to any great extent in the coming season. Mr. Hart mentions it as in great numbers on his Corn at Kingsnorth, Kent, on June 19th, but it was not noticeably injurious. Mr. Fitch notes this Sawfly as being more numerous than he ever knew it. At the end of June (when at all bright between the frequent storms) almost every buttercup flower had its *Cephus* visitor, and often two or three in one bloom, but no larvæ or traces of larval presence were noticeable.



CECIDOMYIA TRITICI.

1—10. Infested floret, Wheat Midge, larva and pupa, natural size and magnified, and antennæ, magnified. 11 & 14 and 13 & 12. Parasite Flies, natural size and magnified.

18. Cecidomyia tritici. Wheat Midge; Red Maggot. Mr. Hart first noticed this Fly on June 25th, and the "Red Maggot" in the Wheat-ears on July 9th; and he considered that although the principal cause of the failure of the Wheat crops at Kingsnorth, Kent, was from mildew, that part of it must be attributed to the "Red Maggots." These were found by Mr. Hart to be common on all his Wheat, sometimes as many as a dozen being on one grain, and the attack was by far the worst that had occurred for some years; last year scarcely one Maggot was observable. At Maldon, in Essex, these Red Maggots were most noticed by Mr. Fitch from the 10th to the 20th of July, but little injury was caused by them. Their absence was attributable to the wet and stormy July, this being the season when the parent Flies are active and busy ovipositing.



CHLOROPS TÆNIOPUS.

2—6. Corn Fly, larva and pupa magnified, and natural size or length given by lines, and infested Corn stalk. 7 & 8 and 9 & 10. Parasite Flies, natural size and magnified.

19. Chlorops tæniopus. No observations.

20. Aphis granaria. Wheat Aphis. A few species were noticed on Wheat-ears at Maldon, during August, by Mr. Fitch, but no real attack.

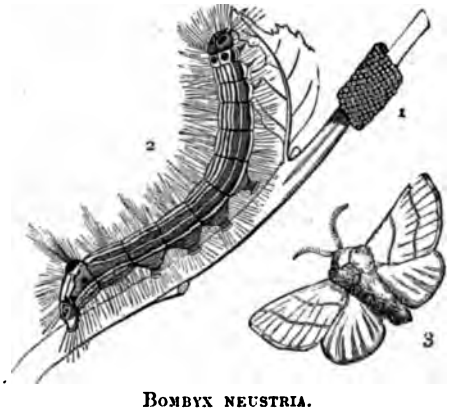
21. Cossus ligniperda. Goat Moth. This has been much more numerous than is usually the case near Maldon. Mr. Fitch noticed as many as eight or ten of the Moths; the empty pupa-cases were noticeable protruding from old Willow trunks, and in the autumn the full-grown larvæ were more than ordinarily common. Mr. Bairstow also mentions that *C. ligniperda* has been more than commonly plentiful. Mr. Malcolm Dunn notes it as not numerous in the district round Dalkeith, and that it is a good remedy to inject paraffin by a sharp-nozzled syringe with as much force as possible into the holes where the Caterpillars are working. Mr. Simpson notes that an old Oak cut down on the Brahan estate, near Dingwall, was found to contain hundreds of the Caterpillars, from a quarter of an inch to four inches long, with empty chrysalis-cases in the bark.

22. Zeuzera Æsculi. Wood Leopard Moth. This is mentioned by Mr. Robert Coupar as very numerous at Craighall, Blairgowrie, many empty pupa-cases being observable in young Poplars at the water's

edge. This Moth was quite unnoticed at Maldon, where in the previous year (1879) it was plentiful. A note is given of a Caterpillar of this Moth being found in the stomach of a Cuckoo. Mr. Shipman mentions that the Fruit and Timber Trees at Ivy House, West Ham,

ZEUZERA ÆSCULI.

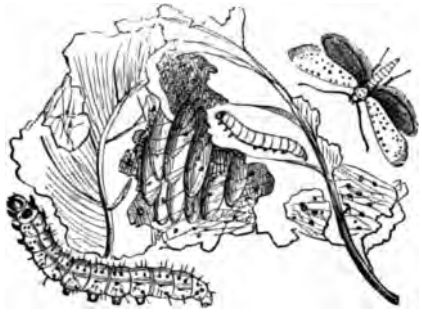
Essex, have suffered very much this season from the Caterpillars of the Leopard Moth; and he adopts the method of forcing a strong wire up the boring of the Caterpillar to destroy it in its hole. He points out that if when the wire is withdrawn it is found to have wet whitish matter on it the Caterpillar may be presumed to be killed; or where the presence of the Caterpillar has been shown by the woody matter it discharges lying outside the boring, that if this is cleared away and no more appears the work of destruction may be considered completely performed. The application of paraffin, as described above, is noted as also a good remedy for destroying the Caterpillar of this Moth.



BOMBYX NEUSTRIA.

23. Bombyx neustria. Lackey Moth. Rarer than usual, both as to Caterpillar and Moth, at Maldon. Rather common, but not

nearly so many as usual, at New Malden, Surrey. Only one specimen observed at Craighall, Perthshire.

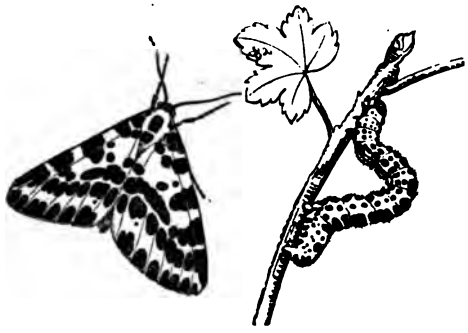


YPONOMEUTA PADELLUS.

24. Yponomeuta padellus. Small Ermine Moth. Mr. M'Donald notices this as very destructive this season near Kirkwall, Orkney; and Mr. Simpson also mentions that at Brahan Castle, Ross-shire, it was very destructive to Plum trees, and especially so on the under branches of standards, and on walls facing the east. Trees on walls having a west aspect were quite free, which is ascribed to the wind and rain during the season being mainly from the west. Mr. H. J. Dobson mentions that the Caterpillars of these Moths completely destroyed the foliage of two Whitethorn hedges at New Malden, Surrey, these hedges being half a mile apart, and the same that were attacked by the Caterpillars of *Liparis auriflua*, the Yellow-tailed Moth, last year. Mr. R. A. Rolfe notes that in June the hedges near Nottingham were swarming with these Caterpillars, their webs abounding to a greater amount than he had ever seen before. The Fruit trees also suffered, but not nearly so much as the quick-hedges, which appeared as if scorched from the injury to the leafage.

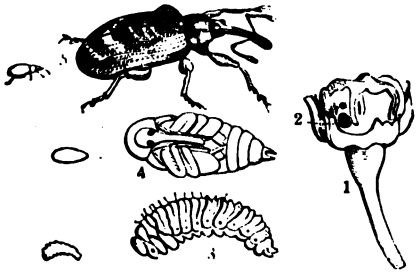
25. Abraxas grossulariata. Magpie Moth. Mr. M'Donald notices the *A. grossulariata* as destructive to Gooseberries and to Red and White Currants at Kirkwall, Orkney, and that dusting with hellebore powder is an effectual remedy. It is also noticed by Mr. Russell as plentiful at Poltallock, Argyllshire, on Black Currants at the north side of a wall, and a good deal of damage was done. Hellebore and hand-picking was resorted to, to clear them. At Dalkeith this attacked Gooseberries and Currants rather severely during the summer. Mr. Dunn notes that a dusting of powdered hellebore, first wetting the bushes to make it stick, is a sure and easily applied remedy; but care must be taken to see that the powder is perfectly washed from the berries before they are used, as it is a dangerous

poison. Mr. Anderson mentions that this Moth is never seen at Oxenford Castle, Mid Lothian. This is noticed by the Rev. W. F. Adams as very plentiful at Little Faringdon, Lechdale, and the larvæ as being numerous on the Currants; but the development was much checked this year by Ichneumon Flies. Mr. Arkwright, of Hampton Court,



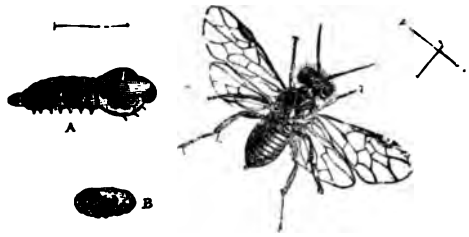
ABRAXAS GROSSULARIATA.

Herefordshire, mentions the Caterpillars of *Abraxas grossulariata* as being the greatest pest in his garden this season; the means of prevention used were syringing the leaves with Gishurst compound. Mr. F. Norgate notes the "larvæ common at Sparham from the 6th to the 18th of June, but almost confined to Blackthorn. Not injurious." Mr. E. A. Fitch also notices the Caterpillars as numerous at the end of May and throughout June on Blackthorn, at Maldon, Essex. By the middle of July the Moths were very abundant, and the Caterpillars still plentiful, but not a single specimen was to be found on Gooseberry or Currant. At New Malden, Surrey, they were rather common. At Kingsnorth, Kent, not one Caterpillar, and only two Moths were observed by Mr. Hart during the season.



ANTHONOMUS POMORUM.

26. Anthonomus Pomorum. Apple Weevil. This is mentioned by Mr. Sutherland as very destructive at Langwell, Caithness.



ERIOCAMPA ADUMBRATA.

27. Eriocampa adumbrata. Pear-Tree Slug. Mr. Dunn mentions this as being again rather numerous at Dalkeith, but easily got rid of with soap-suds and a powerful garden engine, applied at once as soon as the insects are seen. A few noticed on Cherries and Pears at Maxwelltown, Dumfries, by Mr. R. Service, but the attack not to an injurious extent, excepting on some large trees of Bird Cherry, *Prunus padus*, which were badly defoliated. Also sparingly noticed by Mr. Fitch, at Maldon, on Cherry and Blackthorn, but not on certain Pear trees which in former years have been badly attacked.

28. Nematus Ribesii. Gooseberry Sawfly. This appears to have been more prevalent in England than in Scotland; and it is mentioned by Mr. Brunton that at Glenarm, Co. Antrim, it also only made its appearance in such small quantities that a few handfuls of roached lime scattered over the infested bushes soon stopped the ravages. Mr. Sym Scott mentions that at Ballinacourte, Tipperary, the Gooseberry Caterpillar made its appearance on the 17th of May (which he notes as curiously enough the same date at which it appeared in 1879). He put on hands at once and cleared the garden; and thus, although very numerous, the insect was completely checked. At Torloisk, in the Isle of Mull, little damage was caused by the Caterpillar. Mr. Loney observes that the Caterpillars have been scarce at Marchmont this year, and that syringing with tobacco-water is a good remedy if taken in time. At Craighall, Perthshire, Mr. Coupar notes the Sawfly as not as common as in previous seasons. At Skibo, Sutherlandshire, Mr. Forbes mentions the attack as slight this year, and finds hand-picking, if taken in time, the best cure. Mr. Sutherland notes the Sawfly as first observed on the 20th of May at Langwell, Caithness, and has the Caterpillars shaken from the bushes and crushed. He also finds that sprigs of Broom laid on the Gooseberry bushes are a good preventive of attack, as the Sawfly dislikes the smell, or for some reason has an aversion to this plant. Mr. Sutherland finds that if pieces of woollen cloth are laid in the bushes the Sawfly will deposit her eggs on them, and thus many may

be got rid of. Mr. M'Kinlay, Dingwall, gives the very excellent advice that when there is reason to fear an attack the soil should be removed to the depth of two inches round the bushes in the early spring, and a good sprinkling of lime dusted round each bush. By this means the Caterpillars are cleared away and destroyed.*

With regard to remedies, scattering lime round the bushes was tried with fair success, as also putting a bunch of Broom in the middle of each bush. Mr. M'Kinlay also found syringing with water of a warmth that was just bearable to the hand was a good means of clearing the Caterpillars; but he cautions as to the necessity of experimenting first as to what warmth the foliage will bear, as tender leafage may be discoloured or killed by a warmth that may be perfectly safe to use a few weeks later. At Brahan Castle, Dingwall, Mr. Simpson reports the Caterpillar as very abundant on above 700 Gooseberry bushes in June, together with Green Fly which covered the points of the young shoots. The bushes were gone over in June, and the Caterpillars and Green Fly gathered into baskets and destroyed, and the bushes were clear afterwards. Mr. Russell notices the Caterpillars as being less abundant than usual at Poltallock, Argyllshire. Mr. Service mentions amongst remedies used in the district of Maxwelltown that soap-suds syringed on the bushes were very useful; also that it is said that fresh tan-bark from the tan pits put on the ground under and around the bushes during the winter destroys the insect. Mr. Anderson mentions that there were a few larvæ in the gardens at Oxenford Castle in most years, but for twenty years they have not occurred in any quantity. The surface soil under the bushes is annually removed in winter, a deep hole is dug in one of the quarters, and in this the removed soil, with whatever may be in it, is buried. The soil under the Gooseberry bushes is replaced by that out of the hole, with the addition of some manure. It will be observed in this plan of treatment that Mr. Anderson mentions he has a *deep* hole dug: this is important to notice, as if there was only a light covering many of the larvæ would not be the worse for being moved, and come up again in the spring to infest any Gooseberry bushes near enough for them to crawl to.

Mr. Whitton, Coltness, Lanarkshire, notices that the Gooseberry Caterpillar (*N. Ribesii*) made its appearance soon after the bushes were in leaf, and first on those that had been attacked the previous season; and he observes that they used sulphur-powder, as recommended by Mr. M'Corquodale, p. 27 of Report for 1879, and found it as efficacious as hellebore-powder, without the fear of possible evil consequences

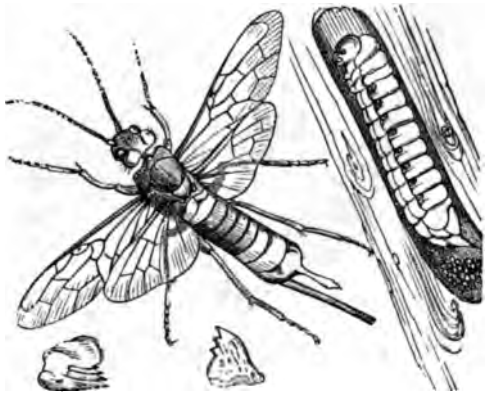
* The Caterpillars go down into the ground beneath the bushes in the autumn, and change to pupæ in the spring, and the moths from them come up again when the leaves are beginning to come out. The treatment above advised gets rid of them thoroughly.—Ed.

from using poison. Mr. M'Laren, Hopetoun, Queensferry, notes that a solution of alum in water, applied lightly by means of a watering-can, is useful in clearing the Caterpillars. Mr. D'Urban, writing from Exeter, notes the Sawfly as very destructive in the middle of May to Gooseberries and to Red Currants, but afterwards it did not give much trouble, the long drought being apparently unfavourable to the insect; and he adds a caution regarding danger in the use of hellebore powder from risk of the powder not being thoroughly washed off the berries. Mr. Matheson, after mentioning that when bushes are very badly attacked dry hellebore-powder puffed over and through the bushes kills all it touches, adds that a good washing with the garden-engine will clean the fruit of the powder, but that it is very necessary for the operator to well protect the nostrils, for the powder has a most irritating effect, causing excessive sneezing.* Mr. Matheson notes that the Gooseberry Caterpillar was very injurious this year at Addington, Bucks, from the middle of May. He remarks that the bushes require careful watching from the first unfolding of the leaf. The first sign of the Caterpillar presence is generally some of the leaves looking as if riddled with dust-shot, and every leaf so attacked should be picked off at once and destroyed, being the home of two or three dozen Caterpillars, which in a few days would spread over many leaves.

At Kingsnorth, Kent, the Caterpillar was so abundant that the bushes in many gardens were almost defoliated. Mr. Hart notes that he prevented serious injury to his own bushes by shaking down the Grubs whilst quite small and crushing them on the ground, and by hand-picking later on. Near Guildford the Caterpillars were at work by the 20th of April in a warm garden. Mr. Long mentions the Gooseberry Caterpillar as very numerous this season at Henlow, Herts; and Mr. Fitch notices that the Caterpillars were so numerous that the Gooseberry and Currant bushes in his own garden at Maldon were more or less defoliated by them. He mentions that hand-picking failed to check the ravages as it had done before, but conjectures that this was from the operation not being as carefully performed. The first brood of Caterpillars, which were very abundant at the beginning of June, appeared most partial to the Gooseberry bushes; the second brood, which appeared about the middle of July, chiefly infested the Currants. At Little Faringdon, Lechlade, the Rev. F. Adams notes the Caterpillars as having almost destroyed the Gooseberries and Currants, and that the crop was only saved by hand-picking, and

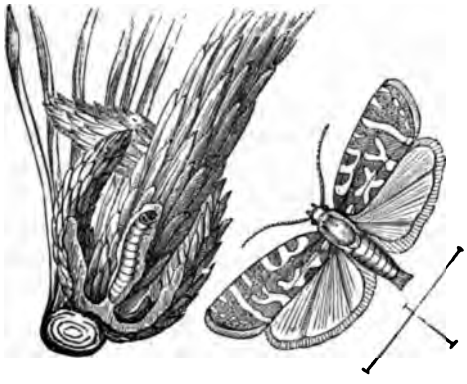
* Looking at the unpleasant effects on the operator, the risk of the berries not being washed clean, and the serious illness likely to follow on hellebore-powder being swallowed, the remedy appears to me only admissible under the most careful superintendence.—Ed.

shaking the bushes into sheets placed under them. Mr. Scowcroft observes that the crop of Gooseberries was small at Ormskirk in consequence of the severe attack of the Caterpillars on the bushes in 1879; but at the date of writing there had not been any great number of Sawflies.



SIREX GIGAS.

29. Sirex gigas. No observations.

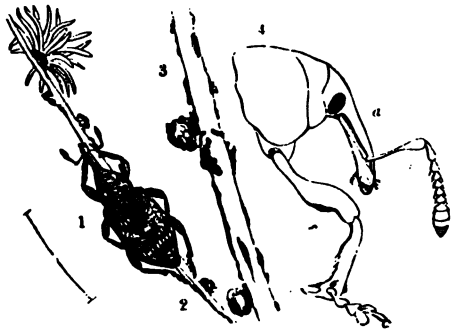


RETINIA TURIONANA.

30. Retinia Turionana. No observations of the present season.

31. Hylobius Abietis. Mr. Wilkie notices that although this Beetle was much less destructive at Ardkinglas, Argyllshire, than in the two preceding seasons, yet it attacked numbers of young plants

not only on ground recently replanted, but also in several isolated cases where a crop of timber had not formerly been grown. The Weevil also attacked several plants of *Picea Lasiocarpa* in a pinetum that had recently been formed on the estate. Mr. Wilkie observes



HYLOBIUS ABIETIS.

that, as far as his personal experience goes, the best method of preventing the propagation of this insect is carefully to cut down all dying trees and remove them (and all other old wasting timber), and burn or otherwise destroy them. Hand-picking is not very successful, as the Beetles drop from the trees on disturbance. Mr. Wilkie observes that all the plants to which "Messrs. Davidson's composition" had been applied (to keep off rabbits) had been quite free from Weevil attack. Mr. M'Laren, Hopetoun, East Lothian, also notices the difficulty of doing any good by hand-picking in consequence of the Beetles feigning death on disturbance and falling to the ground, where from their greyish colour they are difficult of observation, and mentions the best cure in this case was to set boys to pick them into wide-mouthed bottles and destroy them. Mr. M'Laren mentions that in the first attack of this Beetle, which came under his notice some years ago at Lennoxlowe, in East Lothian, their attacks were chiefly directed against the Larch (in the first June after they were planted), commencing at the ground and stripping the plants of their bark, thereby causing the death of a considerable number before the real cause was discovered. To prevent the attack recurring the Beetles were traced to their breeding places (old Firs lying on the ground), and these were burned. Mr. W. Robertson, writing from Blinkbonny, Earlston, mentions that the *H. abietis* has again been present on the plantations this season, and considers that where planting has to be done on a large scale, and the Beetle is present to any extent, the best plan is to take out as many of the old roots as possible, burn all the rubbish that is lying about, and graze the ground with cattle for three or four years

before re-planting. Mr. Robertson thinks this method succeeds best in the end, as planting where there is Pine Weevil is one of the most precarious operations a forester can undertake.

HYLURGUS PINIPERDA.

32. Hylurgus piniperda. Mr. Wilkie, Ardkinglas, Argyllshire, notices the *Hylurgus piniperda* as prevalent on some of the older Pines, but that it was comparatively limited in young plantations. Mr. Robert Coupar, writing from Craighall, Perthshire, observes that it has not been as numerous in 1880 as in the previous season. He mentions the Beetle as very destructive to Pines of all ages, from trees newly planted up to those sixty years old, but that the attack is worst, or at least the damage is most serious, to the young woods, rather than to the old matured Pines. The Beetles, when developed from the

larval galleries bored beneath the bark (of which a figure is given from specimens forwarded by Mr. Coupar), fly to the young shoots,

and bore an entrance-hole either into the shoot of this year's growth or that of the previous year, and gnaw a boring, usually upwards, but sometimes downwards. If upwards, they commonly effect an exit by piercing a little hole at the top; but sometimes they turn and effect their exit an inch or two lower, and it is noted that they at times effect their entrance at the upper part of the year's shoot, and work downwards into that of the previous season. The damage is great, as the injured shoots lose their leaves, or only partially develop them, and a bushy, stumpy growth ensues in the following year at the ends of the attacked branches. The infested trees may be known by this appearance, as well as by the brown colour, in the winter, of the shoots which have been bored up the centre in the previous summer or autumn. Mr. Coupar mentions that he thinks when the time of the Beetles for feeding in the shoots is over that they take to sickly trees, old Scots Pine, or any forest rubbish to lay the eggs of the future brood. He mentions that he has met with the Grub in dead wood at all times, and finds that the eggs are laid in trees of all ages, not only in old wood; he has also taken the Grubs from young Pines of about ten years old, which were lying about dead. The illustration shows the large central gallery pierced beneath the bark by the mother Beetle for oviposition, with the galleries eaten from each side of it by the Grubs, gradually increasing in size as the growing larva gnawed its tunnel correspondingly of convenient size. Mr. Malcolm Dunn mentions that the district of Dalkeith is pretty clear of this Beetle, and considers pinching off the infested shoots and burning them is the best remedy in the case of small trees. Decaying wood or bark is the favourite breeding-place of the Pine Beetle (and troops of other noxious insects), and this should be systematically collected and burned in Pine woods to prevent the increase of insect pests. Mr. Service observes that the *Hylurgus piniperda* was not noticeable this year at Maxwelltown, Dumfries.

Passing on to Injurious Insects not mentioned in the list, the most remarkable appearance of the season was that of the Beet Fly, *Anthomyia betæ*. This is a small ashy grey, two-winged Fly, somewhat less than a quarter of an inch in length, and somewhat under half an inch in the spread of the wings. In the male the abdomen is linear, with a black triangular spot at the base of four of the segments; in the female the abdomen is enlarged immediately behind the thorax, and then tapers rapidly to a blunt point; also there is a dark stripe along the centre, and a fainter one on each side. The eyes nearly touch on the top of the head in the male; in the female they are at some distance apart, and have a band round them, as figured on the front of the face, these bands having a row of minute dark dots along the

centre. The flies are sprinkled with black bristly hairs, and the legs are also bristly. The larva or maggot is about one-third of an inch long, white or tinted with greenish, somewhat pointed at the head, and blunt at the tail; it is legless, and resembles the larva of the Celery-leaf miner. Like it, the maggot of the Beet Fly feeds between the two sides of the leaf, gnawing away the cellular tissue, and thus reducing the part of the leaf attacked to a mere empty blister. Mr. Norgate noted larvæ as abundant in the Mangold leaves at Sparham on the 20th of June. On the 1st of July Mr. Norgate dug round some of the attacked Mangolds, and found the pupæ (to which the larvæ had turned) about three inches below the surface of the ground. "One field of nineteen or twenty acres was considered to be set back about three weeks by the injury to the leafage." From these pupæ, Beet-flies hatched on the 7th and on the 13th of July, and on the 1st of August Mr. Norgate captured many of the flies at rest on the Mangold leaves, and found a large number of eggs on the under surface of the leaves. The larvæ appeared now more numerous than before, and the whole field looked brown with the dry and blistered leaves; and on the 29th of September Mangolds at Sparham are noticed as "fresh blown" by the flies. Mr. Norgate's observations thus show certainly two broods, and probably three, in the course of the season, and also, as he found the pupæ in the earth, and no specimens that he observed turned to the pupal state in the leaf, it points to the class of remedies needed to get rid of them.

ANTHOMYIA BETÆ. Eggs and head, mag.; pupa, nat. size and mag.

The Beet Fly has not been much observed in previous years, but in the present season injuries to the Mangold crops have been reported as more or less prevalent over the country (from the East to the West of England, and as far north as the neighbourhood of Dumfries, and also in the West of Ireland), which have either certainly been caused by the maggot of this Fly, or may reasonably be attributed to it. Mr. Service mentions dipterous larvæ as mining in the leaves of a field of Mangolds at Slogarie, and doing much damage.

Mr. Fitton, writing from Cheerbrook Nantwich, Cheshire, reports that, in the case of a Grub destroying the leaves of the Mangolds (in its method of working similar to that of the Celery Fly), different

parts of the field were dressed with guano, soot, and mineral superphosphate; all had a good effect, but the superphosphate the best.

Mr. Harley Kough, of Church Stretton, supplied me with specimens reared from larvæ taken in the Mangold leaves, and forwarded still secured in the bottle in which they had undergone their transformations, from one of which the accompanying figure is sketched.

The Mangold leaves showed some amount of attack in a large field near Isleworth, but were not much harmed, and in a large number of leaves which I examined I did not find a single larva had turned to pupa in the leaf.

Dr. R. J. Mahoney, of Dromore Castle, Kenmare, Kerry, notes the attack of a larva of a species he had not noticed in previous seasons on the leaves of the Mangolds, The leaves withered off here and there, but the roots did not suffer.

At Ballinacourte, Tipperary, Mr. Sym Scott notes, on the 25th of August, that the Mangolds were sadly destroyed by *Anthomyia betæ*, which he had never before seen. It appeared about the beginning of August, and the injury was at first taken for the effects of frost; the crop suffered much damage.

Phædon (Gastrophysa) polygoni. Mr. Harley Kough, on the 22nd of June, mentioned that the Mangold crops were severely injured in the neighbourhood of Church Stretton and many parts of Shropshire by a Beetle, which lays myriads of white, long eggs on the under side of the leaves, from which the larvæ soon hatch and feed on the leaves where the eggs have been deposited. The specimens forwarded proved to be *Phædon (Gastrophysa) polygoni*, a small oval Beetle less than a quarter of an inch long, of a blue or greenish colour, with thorax bright shining red, the tip of abdomen and legs also red, the horns black and red at the base. This Beetle is to be found on the common Wild Knot grass, *Polygonum aviculare* (from whence it takes its specific name), also on Dock and Sorrel. It is mentioned by Mr. Kough as not having been previously observed on the crops in the neighbourhood, and the Beetle is noticed as difficult to capture on account of its habit of dropping from the leaves on any disturbance, and burrowing into the ground. The heavy rain did much in clearing the Beetles and larvæ, but the eggs, being on the under side of the leaves, remained still attached.

Ceutorhynchus sulcicollis. The Cabbage and Turnip Gall Weevil is noticed by Mr. Sutherland as very prevalent this season near Berridale, Caithness, and he mentions gas-lime and soot, also seaweed and salt, as good applications to prevent attack.

Carpocapsa pomonella. The Codlin Moth (of which the Grub often does much damage by feeding inside the fruit and causing what are known as "worm-eaten" Apples), is noted by the Rev. F. Adams as about this year at Little Faringdon, Lechlade, "a most unusual thing here;" and I can report its unusual absence in my own garden.

A fine specimen, five inches long, of the Caterpillar of the Death's Head Hawk Moth (*Acherontia Atropos*), was found in a Potato field near Forres, Morayshire, and is mentioned by Mr. D. Scott.

Wasps have been extraordinarily plentiful, the visitation apparently reaching its height in the Stewartry of Kirkcudbright, in Scotland, and at Glenarm, Co. Antrim, Ireland. At the first-mentioned place Mr. Service reports an enormous number of ground nests, and that it was dangerous to walk through the copse woods on account of the nests of *V. norvegica* and *V. sylvestris* hanging in every thicket. At Glenarm the nests, both of the ground and tree Wasps, were so numerous that it is noted by Mr. Brunton that it was with difficulty that some of the meadows were worked. Amongst various means for destruction of ground nests, probably there is none so complete in the operation, and so safe for the operator and for surroundings, as simply pouring a little coal-tar down the mouth of the entrance-hole when the Wasps have returned home for the evening. Mr. Boyd mentions this as having been found very serviceable at Callander; and in W. Gloucestershire, where Wasps' nests are plentiful in the neighbourhood of the orchards, it answers very well, with little trouble.

Aphides appear to have been very prevalent in many places. The Carrot Aphis occurred near Dingwall. Aphides generally are mentioned as most destructive at Poltallock, Argyllshire. Cherry-tree Aphis is mentioned by Mr. Simpson as troublesome in Ross-shire, and Mr. Dobson mentions a severe attack on the Hops on the 21st of June, these being subsequently cleared by the Ladybird larvæ by the 5th of July. Mr. Dobson notices the large appearance of Aphides coincidently in date with the *Cicada spumaria*, commonly known as the Cuckoo Spit or Froth Fly insect; and Mr. Long, of Henlow, also notices the great appearance of this insect as being considered a forerunner of that of the Aphides.

Mr. Hart, of Kingsnorth, Kent, notes that Aphides have abounded on almost overything. He noted them on Wheat, Barley, Oats; Beans, Peas, Tares, Lucern, Yellow Vetchling; Cherry, Gooseberry, Raspberry, Apple, Plum; Lettuce, Radish; Oak, Birch, Elder, Guelder Rose, Blackthorn; Hop, Nettle, Thistle, Sow-thistle, Dock, Black Knapweed, Meadow-sweet, Mouse-ear, Hogweed, Reed, Poppy, Purple Loose-strife, May-weed, Fat-hen, Calceolaria, Pelargonium.

This long list is of much interest relatively to the appearance of

any one species on its wild food-plant, and also on the crop which it may infest. Thus we have the species (*Aphis rumicis*) infesting the Beans also noted on its wild food-plants, Docks and Thistles. The Hop Aphis also frequents the Blackthorn and the Plum, and, whilst the absence of the Aphis is noted from the Turnips, there is a corresponding absence of entry of other plants on which, as far as I am aware, this Aphis more especially feeds. Mr. Malcolm Dunn notes that the Larch Aphis prevailed extensively in almost all parts of the country where the tree is grown.

Syringing with soap-suds is the remedy which appears best known amongst those noted, and is mentioned as being very serviceable.

The observers unite in pressing the importance of the preservation of Birds. The Rook has been seen doing good service in clearing off the Crane-flies; the Lapwing also needs a word to save it, for our benefit, from indiscriminate slaughter; the Starling is a good helper; also the Cuckoo, from its liking for, and capacity for swallowing, the larger larvæ; and, though with regard to the Titmice I am bound to note the comment of an observer with regard to the Blue Tit, "that a more destructive little rip does not exist," yet the family in general, and I am inclined to think this member also, would be greatly missed if not allowed play on the Aphides.

Looking at the results of this year's observations, it will be seen that they point to the importance of such treatment of the soil as may press on a hearty, healthy growth, and to counteracting direct insect attack by special methods of cultivation, based on knowledge of the insect habits, rather than on applications to the insect itself. Thus with Carrot Fly, with which the method of attack is for the Fly to bore down through any cranny and lay its eggs on or close to the root, it will be seen that the advice not to thin when the Carrots are of a size that would open the earth round them in removal,—to avoid a dry time for thinning, and, after thinning to water well with water, or any fluid that is deterrent to the insect,—meets the above point. The watering puts the earth together again, and fills up the crannies, and so excludes attack.

With the Caterpillars of the Gooseberry Sawfly, which pass the winter in the surface soil beneath infested bushes, ready to change to chrysalids in the spring, and come up again as perfect insects with the return of warmth, the most successful method of prevention is to clear off the surface soil with the Caterpillars in it, or so fork, lime, and otherwise treat the few uppermost inches of earth as to destroy the contained pests.

In the case of the *Tipulæ* larvæ, the grubs of the Daddy Longlegs, it will be noticed that the application of guano was successful by affording a temporarily strong supply of food to the plants which were

temporarily (through the gnawing of the grubs), deprived of full power of drawing in food, and consequently were to a certain extent starving.

Special applications and dressings must often be needed to check unexpected attack, and therefore all details of such applications are of service ; but if the general rules of treatment with regard to any of the common insects not yet fully reported on should be laid down by observers as thoroughly as has now been done regarding Carrot and Onion Fly, and Gooseberry Sawfly, we should all benefit greatly.

I would suggest that such information is particularly needed regarding the Cabbage Moth, *M. brassicæ;* and also that the Pea Weevils and the Celery Fly are insects which need much more attention.

I now wish to offer a few words to the contributors to whom I am indebted for the notes of observation given in this Report. During the autumn I have been favoured with much useful information, contributed partly for the Report, partly for the Manual, which, with this assistance, I am preparing relatively to means of prevention, or of remedy for attack of all our most commonly injurious insects. In the publication of these notes I have followed the wishes of the contributors, as far as I was aware of them, but where I had no directions I have given in this Report such information as referred to the injurious insects on the observer's list, and mainly reserved the other points, as well as in some cases the full detail of the method of operation, for the forthcoming volume.

Amongst these latter observations I may especially mention some on Larch Aphis, and also on Pine Sawfly. It appears to be desirable to mention this, lest I should seem neglectful of the observations with which I feel it a favour to have been entrusted ; and as it is with the assistance of a large proportion of the contributors to this Report that I am forming the Manual, I do not deem it out of place to add, on the cover, a note of the progress of that work.

The promise of contribution of information for the next Report is on a much more extensive scale than has hitherto been the case, and on my part it will be my endeavour to devote thorough attention to whatever may be entrusted to my care. Hitherto I have mainly limited myself, in publication, to mention of the Injurious Insects on the observer's sheet, but in the next Report I purpose to publish all observations that I may be favoured with regarding any kind of our *Injurious* Insects, or matters connected with their prevention, and also to give many more illustrations. Meanwhile I should have pleasure in attending, to the best of my power, to any applications

regarding prevention of the ravages of Injurious Insects. Any application would also be attended to as before by the Rev. T. A. Preston, Marlborough, and E. A. Fitch, Esq., Maldon, Essex.

In consequence of the increasing circulation of the Report, it has been thought desirable to publish in Edinburgh as well as in London. Messrs. Menzies have undertaken the Edinburgh publication, while that in London remains in the hands of Messrs. Sonnenschein and Allen. It will as before be forwarded, immediately on publication, free to all contributors, and as I find, to my regret, that a few copies forwarded last year did not reach their destination properly, I will add a request that should this have happened in any other case the contributor will kindly let me know, that I may forward the Report due.

ELEANOR A. ORMEROD, F.M.S., &c.

DUNSTER LODGE, NEAR ISLEWORTH,
December 22nd, 1880.

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REPORT

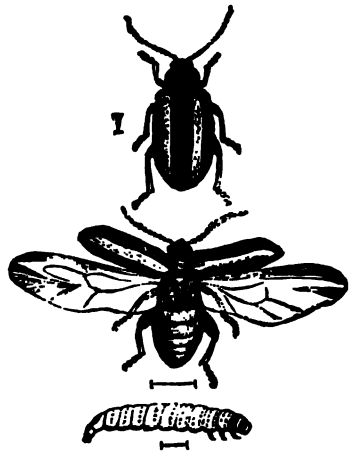
OF

OBSERVATIONS OF ATTACK

OF

TURNIP FLY

IN 1881.



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LONDON:

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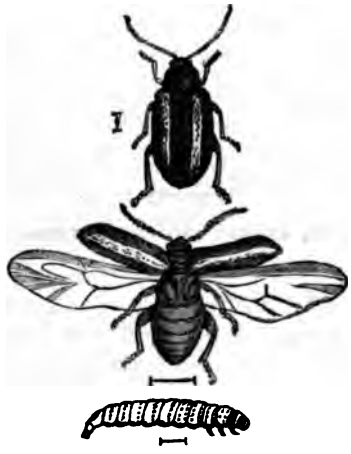

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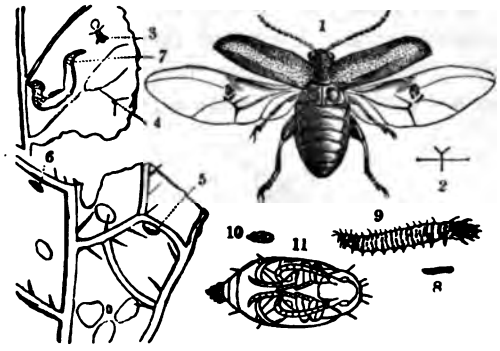
Turnip "Fly." *Phyllotreta nemorum.*



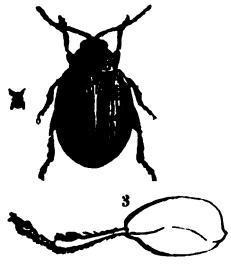
1—3, *P. nemorum;* 4, 5, eggs; 6—9, maggots; 10, 11, pupa; all nat. size and magnified.

The unusually severe attack of Turnip Fly in the season of 1881 to a large amount of the Swedes and Turnips both in England and Scotland, and the attention consequently directed to the subject, suggested that, if whilst the amount of injury was still fresh in the memory, those possessed of information would give details of the extent of the losses sustained, and of any means found practically of use either in preventing or remedying attack, such information would be of great service to us all in drawing observation generally to the importance of the losses caused by this farm pest, as well as in showing that means lying in the ordinary measures of good cultivation are of service in checking the evil.

With this view circulars requesting information were forwarded to agriculturists, and others interested in the subject, in various localities throughout the country, which have been replied to far more minutely and fully than I ventured to hope; and, whilst I express my thanks to all those who have so courteously and ably assisted me, I wish especially to acknowledge the valuable help kindly afforded me, through the aid of Mr. Dent-Dent, President of the Royal Agricultural Society; also by Mr. C. Whitehead, Chairman of the Seeds and Plant Diseases Committee; and by Mr. J. H. Arkwright, of Hampton Court, Herefordshire, on the Council of the same Society; and by Mr. F. N. Menzies, Secretary of the Highland and Agricultural Society of Scotland.

For convenience of reference this information has been divided and classed in the following pages under various heads, showing the amount of attack in the localities observed, accompanied in some cases by estimates of loss; also notes regarding methods of cultivation and state of tilth found best suited to prevent fly-attack and encourage a good plant-growth; seed; dressings; applications found of service when fly is present; and other points bearing on prevention of attack.

The pest under consideration is for the most part referred to in these pages as "Turnip Fly," not by its scientific name, because the various kinds that injure us, whether they have a stripe along the wing-cases, like *Phyllotreta nemorum* (see above figure), or like *P. undulata;* or are brassy, like *P. concinna*, sometimes known as the



PHYLLOTRETA CONCINNA.
1 and 2, Hop Flea, nat. size and magnified; 3, hind leg, magnified, showing tooth.

Hop Flea-beetle, or Tooth-legged Beetle; or may be of others of the many species of *Phyllotreta*, or *Haltica*, as it was formerly called; still these are all "Fly" or "Flea" beetles, and, as far as we know, have all the same method of life; injure us more or less in the same manner (*P. nemorum* and *undulata* to the greatest extent with regard to Turnips), and are kept down by the same means. They live during winter, whilst torpid, under sheltering clods and rubbish, and in spring the Turnip-flies come out to feed on anything they can find of the Turnip and Cabbage tribe, especially such weeds as charlock or jack-by-the-hedge, until the young Turnips are ready for them, when we know too well where their preference lies; and there are several broods, sometimes as many as five or six, during the season. These are carried on by the female beetle laying eggs beneath the Turnip leaves. Small whitish maggots (see figure) hatch from these, and make their way into the pulp of the leaf, where they feed, and from which, when full fed, they come out and bury themselves about two inches deep in the ground, where they turn to chrysalids (see figure). From these chrysalids or pupæ the Turnip "Fly" or Flea-beetles are developed, and come up from the ground about thirty days after the date of the laying of the eggs from which their lives started.

The observations contributed show that attacks occurred in 1881 at various points in England, in the counties extending from Northumberland and Cumberland along the coast by Kent to Devon and Somerset, including in this range some of the more inland counties, as Beds, Herts, Wilts; and also the Isle of Wight. In the South Midland and Western districts, it occurred at localities in Oxfordshire, Gloucestershire, Monmouthshire, Herefordshire, and Derbyshire. It is mentioned by a contributor as less prevalent in Staffordshire; it is noticed at one locality in Cheshire; and West Lancashire is said to be never troubled with it; and the very few observations from the Principality, both from South Wales, mention freedom and presence of attack respectively at two localities near Brecon, and little to complain of near Bridgend, Swansea.

In Scotland the "fly" was exceedingly destructive in the southern counties, and is noticed as infesting the counties of Kirkcudbright and Dumfries; and also present to a serious extent in the border counties to Berwick, and up the east coast to Fife; also present in Lanark, and as far north as Perth and Argyle, but absent in the Isle of Mull; and at the extreme north in Caithness, where observations were carefully made for many weeks (and specimens forwarded accompanying), the mischief was caused not by the "fly," but by a very small weevil, very like the Turnip-gall Weevil in appearance, which proved to be the *Ceutorhynchus contractus*. In answer to special inquiry as to amount of "fly" in Orkney, it is mentioned that the Turnip Fly is scarcely ever seen there.

In Ireland "fly" was injurious at two localities in Antrim, in the Glenarm district, and by the shores of Lough Neagh; but these are the only two returns of attack I have received from that country.

Taking some of the best returned localities in England, we find that in the most northerly district of Northumberland there were three sowings on most farms, and the loss on one, taken as an example of many, was estimated at £320, this being a little less than £3 2*s*. 4*d*. per acre respectively on Whites and Yellows, and rather more than £4 per acre on Swedes. At Silloth, Cumberland, the loss was estimated at little less than £5 per acre.

Many hundreds of acres are noted as having been twice sown, and ultimately failed, in Durham; and in Yorkshire, the observer at Northallerton notes that nearly every one in that neighbourhood sowed twice, and there, and (where observed) elsewhere in the county, there was only *half* a crop; and from near York it is mentioned that the sowings, some for the second time, up to the first week in June, were nearly all destroyed.

In the case of thirteen farms in the parish of Weybread, Suffolk, two escaped, and at one the loss was total. At eight of these farms

resowing was requisite, and there was from no crop to half a crop of Swedes; and at seven of these same farms the Turnips failed. Loss, where estimated, £3 and £5 per acre.

In Hants severe injury and three sowings are mentioned in various localities, with an estimate from one of loss of £2 10*s*. per acre. In the Isle of Wight the resown plant came so late as "practically to give no crop," and this was estimated to be the case on nine-tenths of the island. In Dorset, it is noted, "people sowed Swedes three times over, and had to give them up after all." In Somerset, at the locality noted, there were four successive sowings of Rape and Turnips.

In Herefordshire, the only county of which there is a fairly complete series of returns, we find that notes from localities in thirty-eight parishes, occupying an area of seven miles radius round Leominster, show that at twenty-four of these some proportion (less or more noted on the Herefordshire tables appended) had to be resown once; at twelve others some proportion twice, thrice, or more. With regard to six larger districts of the county lying round Leintwardine, Ross, Tarrington, Eardisley, Pencombe, and Brockhampton, in one district all the early Swedes were damaged, and nearly all had to be resown; in another it is estimated that three-quarters of the Turnip acreage of the neighbourhood was damaged by "fly," and about one-half resown, in many instances resown twice; in another the first sowing of Swedes was wholly damaged throughout the district, and a large area of the second sowing; and in another it is returned "all the Swede crop damaged and almost the whole of it resown, some of it twice." Regarding the two remaining districts, in that of Pennoxstone (Ross) the district suffered much, and many crops had to be resown second and third times; and in that of Brockhampton, by Bromyard, resowing took place twice in several cases, and in some three times.

From Derby it is reported that "most farmers had to sow twice, and not a few even a third time, so that the crop throughout the Midland Counties was late.

In Scotland the visitation was worst in the south; scarcely a Turnip field is stated to have escaped in the counties of Kirkcudbright and Dumfries, and resowings were requisite in many cases twice, in some a third time. In Berwickshire there was great destruction, and resowings requisite, sometimes up to three times; and from inquiry of seedsmen at Haddington, and adjacent counties, it appears one-half more seed was purchased than the usual supply.

The direct amount of money loss on unreturned outlay for seed and resowings in the districts known to have been attacked amounts to an enormous sum, and this can be fairly well estimated; but beyond this there is still a heavy loss to be considered on lesser value of the White Turnip than the Swede crop, and also on the deficiency of the

late-sown crops, as well as in some cases the total loss. Also the deficiency of crop affects other points of agricultural supply, as want of cattle-food, and consequent lesser supply of manure, depreciation of price of stock, &c.; so that it is almost impossible to say how far the loss extends.

A tolerably correct estimate may, however, be formed of loss on seed and resowing, by calculating from the returns sent in what is the number of acres that may be estimated as attacked, and the number of resowings requisite, together with the average price of seed and amount used per acre, and cost per acre of the cultivation for resowing.

Taking only the Turnip Fly attack in England in consideration for present calculations, it appears that in the localities from which returns were sent, in the following twenty-two counties, resowing almost invariably took place, to a greater or less extent, once, in many cases twice, and in some three times; in a few cases fly-attack is named without specified details as causing serious injury, and from the many points at which fly-attack is reported, it may fairly be presumed to have been generally present in these districts; but in the following estimates only half the below-mentioned acreage is considered.

Acreage under Turnips and Swedes, as returned upon the 4th of June, 1881, in the under-mentioned counties of England, from the Agricultural Returns of Great Britain:—

Counties.	No. of Acres.
Northumberland	46,927
Cumberland	32,412
Durham	22,657
Yorks.	196,764
Lincoln	142,300
Norfolk	134,352
Suffolk	58,145
Essex	26,598
Beds	11,912
Herts	22,732
Kent	27,254
Sussex	30,472
Hants	79,178
Wilts	58,157
Dorset	38,639
Somerset	30,754
Devon	75,042
Oxford	34,191
Glo'ster	39,371
Monmouth	7,561
Hereford	22,753
Derby	11,602
Total	1,149,768

If we take half the total of 1,149,768 acres, that is to say, 574,884 acres, as the area to be resown once in the counties under consideration (a calculation which is probably much below the real amount), we shall get a basis for an estimate.*

1st. Taking loss on *seed alone* for one resowing; if we take the price of seed at 9*d.* per pound, and three pounds per acre as the quantity needed, this loss would amount to £64,674 9*s.* 0*d.*

2nd. Taking loss on one resowing of the same amount of acreage, including outlay for scuffling, harrowing, rolling, drilling seed, and possibly some additional superphosphate, we cannot well put the cost per acre under 15*s.* (if ploughing instead of scuffling should be required, it would be some shillings more, say 5*s.*); but taking the outlay as 15*s.*, this would amount to the sum of £431,168 on the 574,884 acres.

If, according to the estimate of some of our agriculturists much better able to estimate outlay per acre than myself, this should be put at £1 rather than 15*s.*, the loss of course agrees in numbers of pounds with the acreage, £574,884 on 574,884 acres.

Looking now at the returns from Scotland, Turnip Fly was present in various localities, or was generally prevalent to a serious extent in the following eleven counties having acreage of Swedes and Turnips returned on June 4th, 1881, as follows:—

Counties.	No. of Acres.
Kirkcudbright	14,596
Dumfries	20,247
Selkirk	2,859
Roxburgh	26,015
Berwick	29,993
Haddington	15,447
Edinburgh	12,495
Lanark	8,552
Argyle	5,256
Perth	31,098
Fife	27,547
Total	194,105

Half of this total of 194,105 acres is 97,052, and, following the previous method of calculation, the loss on this would be for seed £10,918 7*s.*; for one resowing at 15*s.* per acre, £72,789; for one resowing at 20*s.* per acre, £97,052.

* It may save trouble in reference to add that the total area and acreage under Swedes and Turnips in each division of Great Britain, as returned upon the 4th of June, 1881, and given in the Government Agricultural Returns, amount as follows:—In England to 1,478,682 acres; in Wales to 66,356 acres; in Scotland to 490,604 acres; in Ireland to 295,235 acres.

The loss therefore on the amount of acreage named in the twenty-two English and eleven Scottish counties would at the above estimate stand thus:—For seed alone, £75,592 16*s.*: for one resowing, including seed and cultivation at the rate of 15*s.* per acre, £508,952; the same at the rate of 20*s.* per acre, £671,936.

This amounts to just a little more, or considerably more, than half a million, and with the consideration of the great additional losses involved, though from their various nature it is impossible to calculate them accurately without special returns, it gives some idea of the amount of unproductive outlay, which, joined to consequent losses in its train, has made the visitation of Turnip Fly of 1881 nothing less than a national calamity.

In the following pages I give the information with which I have been favoured, as far as possible in the contributors' own words; and it will be observed that I have *not* included in the above estimates several of the counties in which I have only notes of attack isolated from the general area, though conjecturally, with the benefit of more returns, these would have been added to the list.

ENGLAND.

North and East Coast.

Observations regarding amount of presence of Turnip Fly at various localities in England, accompanied in some cases by estimates of loss and details of expenses of cultivation.

Northumberland.—Northern district, taking a radius of eight to twelve miles S.E., and N. of the village of Ford. In this district the large farmers maintain a permanent stock of sheep, and for winter supply of these and of the cattle a large acreage of Swedes and Turnips is required. In no year, probably, has the loss by Turnip Fly been greater than last season (1881).

On the great majority of Turnip-raising farms seed had to be thrice sown, and in one case a farmer sowed no less than twenty pounds per imperial acre before he could get a crop fit to single.

On every farm where sheep are kept, some acres of White Turnips are generally sown (these being matured early) as food for the sheep in the fall of the year; and in many cases these were entirely eaten off, and the Yellow Aberdeen Turnip had to be substituted. To give a single instance: on the farms of Fenwick Steads, Belford, which consists in some places of loamy and in some fields clayey soil, the first sowing was eaten clean off; Swedes were next tried, but these likewise were destroyed; and the whole acreage had to be resown with Yellows, which at last were a fair average crop. The Flea-beetle was noticed swarming by hundreds on the infested ground, but not a

single specimen of the *Ceutorhynchus contractus* (a small weevil destructive farther north, Ed.) was to be seen. Whilst the ravages were taking place the weather was very hot and sultry.

The following table of statistics, with regard to the Turnip-crop at Holborn Grange, Belford, Northumberland, shows the amount of loss on a good well-worked farm, and may be taken as an example of many in the same district (A. S. A.):—

Variety.	Acreage.	No. of times sown.	Seed each time.	Time of 1st sowing.	Time of hoeing.	Rough estimate of pecuniary loss.
Swedes.	37	18 acres twice sown	3½ lbs. per impl. acre	23rd May	15th July	£150 0 0
Yellows.	34	18 acres twice sown	3 lbs. per impl. acre	18th June	End of July	£100 0 0
Whites.	26	Once	3 lbs.	29th June	End of July	£70 0 0
						£320 0 0

Morpeth. At Woodhorn Manor about twenty-five acres were lost by "fly" this year on good Turnip-ground which had been well manured and put in good order; also a ten-acre field of Swedes that were the first sown were badly injured by fly, but recovered enough to give half a crop.—(J. E.)

Cumberland.—The district round Silloth suffered heavily this season from Turnip Flea (*Phyllotreta nemorum*), being once or twice resown. The loss on Turnip crop on many farms from this cause, with possibly some damage also from the caterpillar of the Turnip Moth (*Agrotis segetum*), was estimated at little less than £5 per acre.—(W. H.)

Durham. — Sunderland. During last June Turnip Fly was exceedingly injurious over the whole of this part of the county of Durham; many hundreds of acres were sown twice with Swedes and failed, when as a last resource the softer kinds were sown, which at the best are worth little more than half a good Swede crop.—(J. S.)

Yorkshire, N. Riding. — West Rounton, Northallerton. The general run of Turnip crop in this part of the county and beyond it, where observed, amounted on all strong soils to only half a crop,—the failure was in both Swedes and Turnip from drought and fly. Nearly every one sowed twice, but still fly-attack took place, and it did not answer. The early Turnips suffered most.

The money loss is estimated at £3 or £4 per acre. Value of a good fair crop of Swedes being set at £7, and of White Turnips at £5 per acre.—(C. H. W.)

Wilstrop Hall, York. In reply to your questions respecting the Turnip Fly in Yorkshire, this season the sowings (in some cases for the second time) up to the first week in June were all destroyed; even those put in amongst Mangolds early in April did not escape, the fly being so numerous and vigorous. Those drilled later suffered comparatively little, and the autumn fortunately proving mild they attained a fair growth; this is fully authenticated by farmers in various parts of Yorkshire.—(J. H.)

Goldsborough, near Knaresborough. I had forty acres damaged; twelve acres of Swedes were completely destroyed, and had to be resown; the second sowing was very much injured, and had I not sown four to five pounds of green Globe seed they would all have been destroyed a second time. I had not to sow any a third time; but the whole forty acres were stopped for one month and were not so good by £150 as they ought to have been, and I have no doubt would have been.—(L. P. O.)

Boro-Bridge. A very serviceable contribution of information, giving dates of sowing, dates and amount of attack, &c., is tabulated, and with additions of daily rainfall appended with the other tables.

Lincolnshire.—Limber, Ulceby. Whenever fly appears its attack is very general hereabouts. This year, on the strong land between Limber and the Humber, after sowing three and four times, the July drought was too great, and they got no crop. I can give no reliable estimate of the losses I have sustained from this pest; I may say, however, that the loss of my Turnip crop reduces the produce of that field fully one-half for the whole round of cropping, until the Turnip crop comes round again.—(T. H.)

Norfolk.—Sparham, near Norwich. A note is given of forty acres of Turnips and six acres of Swedes being destroyed by fly; both resown.—(F. N.)

Suffolk.—Weybread. Information contributed by the farmers of this parish shows much harm to have been done by the fly. The details of numbers of resowings, &c., are given in tabulated form, for convenience of comparison, accompanied by a summary of the information, together with the other tables regarding Turnip Fly.

Essex.—Forest Gate. Soil light and sandy. Turnip Fly very destructive during the hot weather.—(W. J. F.)

Witham. On the 28th of July the Turnip Fly (*Phyllotreta nemorum*) was causing much injury to the Cabbage crops in the Labourers' Allotment Gardens, just outside Witham. In some places the crops were completely destroyed, not a vestige beyond the stem being left: and in other places they were fast going, and the beetles ("fly") were observed to feed in companies of as many as five or six, as well as singly.—(W. D. C.)

BEDS.—Biggleswade. One piece of Swedes was quite destroyed by fly, and had to be resown with White Turnips, which also were very much injured by them, and remained only half a plant.—(J. L.)

HERTS.—St. Albans. The damage done by the Turnip Fly in some farms in this neighbourhood is almost incalculable. Some few seem to have escaped, but, generally speaking, after repeated sowings the Swedes have been ploughed up and the ground sown with Rape or White Turnips; or the few Swedes left have been patched with White or Yellow Turnips. On my own farm, out of sixty acres of Swedes, only twenty have withstood the attack of fly; the remaining forty acres have been resown with White Turnips, which will be small, and a poor substitute for a good crop of Swedes.—(F. S.)

Langleybury, near Watford. The Turnip Fly has been very destructive to the crops this year. In the case of one small piece of White Turnips put in for early feed, which comprised Green Globe and Early White Stone, the Green Globe were not attacked; but the White Stone, although sown the same day and adjoining the former, were all taken; these were sown a second time, and were a miserable crop.

The whole of the first sowing of Swede Turnips (the Champions) were destroyed by the Flea-beetle, although there was a good plant, the weather at the time being hot and dry, with harsh winds.

The loss per acre is estimated at—

Extra labour and seed	£1
Loss of weight, through lateness in crop .	£1
Total per acre. .	£2 (A. S.)

Deard's End, near Stevenage. The fly (*Phyllotreta undulata*) has done greater damage to Turnips than I ever knew it to do before, owing greatly to the dry summer and the land not being moist enough to make the plants grow away from them. At least £80 damage was done to roots on my farm this season.—(B. B.)

SOUTH COAST.

KENT.—Kingsnorth. Mainly owing to the fly, the Turnip crops were a complete failure. On the observer's own ground the plants no sooner showed than the fly attacked them and cleared them off. A second sowing, part Swedes and part Turnips, were swept away, notwithstanding there was an excess of moisture, the land being too wet to work on; a third sowing was made as soon as practicable, but it was too late for Turnips; and the only substitutes, Cole and Mustard, did not have time to produce half a crop; the loss is estimated at not less than £50.

The fact that our Turnip crops were so nearly ruined had the effect

of lowering the price of store sheep and lambs from 5*s.* to 10*s.* each at the sheep-fairs and sales round here (Kingsnorth, Ashford, Kent). Many of the large buyers from Essex, Surrey, &c., did not put in an appearance at all, and those who did come only made limited purchases; and this owing to the failure of the root crops. The bearings of the question are so extensive that one hardly knows what interest is affected and what not.—(T. H. H.)*

SUSSEX.—Considerable damage was caused by Turnip Fly (*Phyllotreta undulata*) on farms situated to the north and east of Chichester, where the land is hilly and exposed; whilst those to the south, where the district is flat and low, enjoyed a comparative immunity. Acres of the first sowing of the plants were in many cases destroyed; with the second there was much better luck.—(J. A.)

HANTS.—Downton. The "fly" was by far our most troublesome pest in 1881. The soils on the Down slopes are very light and porous, and Turnips, Swedes, and Rape on both sides of the valley were taken once, twice, and even three times by the "fly"; as a result the root crops are backward and deficient.—(W. F.)

Strathfield Turgiss. The fly is reported to have been very prevalent in this locality, and in most cases three sowings were required. The total loss is estimated at about 50*s.* per acre.—(C. H. G.)

Thruxton. The Turnip Fly (*P. undulata*) was very troublesome here during May and the early part of June, in fact until we got some good soaking ground-rains. I lost all my Swedes after twice sowing, but had a good crop of late Turnips from the same land at the third sowing. I applied no artificial watering or other means to save the crop of Swedes.—(H. R.)

Alton. The Turnip Flea or Beetle has been more than usually hurtful this year; large districts in this county have been entirely stripped of every Swede and Turnip plant.—(D. T.)

Isle of Wight. At Birchwood about twenty-five acres of Swedes and White Turnips (sown broadcast), which came up well, were all lost by the fly; the same land was then resown with Purple White Tops, but from lateness and unfavourable weather the growth was small, so as practically to give no crop; and this case is estimated to represent eight- or nine-tenths of the entire island.—(H. P.)

WILTS.—Mere. In this locality nearly everything sown before the

* Most of the cottagers about here (Kingsnorth, Kent) are in the habit of sowing an ounce or two of some sort of Cabbage-seed in their garden, and selling the plants. The returns are often sufficient to pay the rent of the garden. This year, in nine cases out of ten the Flea-beetle swept the beds of every plant. I sowed about ten shillings' worth of Cabbage-seeds of different sorts for field and garden, and did not save a plant.—(T. H. H.)

first week in June was almost entirely destroyed; since then we have not been troubled at all. As to cost of resowing—this generally entails the expense of an extra ploughing, or at least a scarifying of the land. The former would cost about 10*s.* an acre; to this add two harrowings, 2*s.*; one rolling, 1*s.*; two hundredweight additional superphosphate, say 9*s.*; drilling, including either ashes or water, at least 2*s.* more; this would amount in the whole to 24*s.* per acre, without seed, which would be at least 1*s.* more—that is, supposing the land to be ploughed; if scarified it would be about 5*s.* less.—(T. H. B.)

Dorsetshire.—The Turnip crop suffered greatly from the *Haltica* in Dorset this year (1881); people sowed Swedes three times over, and had to give them up after all, and sow common Turnips. As a rule, the best fields of Swedes are but patchy. My own Swedes are fairly good, eighteen tons to the acre. I fortunately had not to sow a second time, but they were late, or (if the "flea" had not taken them) the crop would have been larger.—(J. B.)

Somerset.—Frome. This year at the end of February I sowed ten acres to Rape, and a few Tares; the Rape was all destroyed by fly. I broadshared the land and sowed Rape, which was eaten; then ploughed and sowed to Turnips and Rape, which was also destroyed; again cultivated the same field, which has proved satisfactory. The last two sowings were with the water-drill and best superphosphate. I also had to sow seven acres of Swedes three times with water and artificial manure.—(T. J. M.)

Devon.—From Exeter it is mentioned on August 1st that the Turnip crops about Seaton and Beer were being devoured by Flea-beetles, in some fields scarcely a plant being left. The fields are difficult to manage, as they are covered with chalk-flints which nearly touch each other and shelter the beetles, but also prevent evaporation in dry weather; so that they are considered indispensable to the crops in dry summers in the light soil of the district.—(E. P.)

Midland and West District.

Oxford.—In the Thame district fly was very busy early in the season, and in many cases the crops had to be sown two or three times. The crop is estimated at about one-sixth of what might have been expected.—(T. B.)

Gloster.—From the neighbourhood of Lechlade. All early-sown Turnips, Swedes, and Rape were this year attacked by the Turnip Fly so much that every one who planted early had to replant.—(W. J. E.)

Cirencester.—At the Royal Agricultural College the loss by Turnip Fly is estimated at about £30. Twelve acres of Swedes were resown once, and four acres twice. Another lot of fourteen acres of Turnips

was more than one-third deficient through the ravages of Turnip Fly. —(A. H.)

MONMOUTHSHIRE.—Immense damage and inconvenience has been suffered this season in the district round Newport from the Turnip Fly, but it is impossible to give a pecuniary estimate of the loss sustained. A crop replanted may be fairly calculated to cost £1 per acre for labour alone, and the later crop would probably be 25 per cent. lighter than the former had it stood; also the damage in the mutilation of crops, which are not quite bad enough to plough up, is of course enormous.—(R. S.)

HEREFORD.—Turnip Fly was very injurious in this county. Information as to amount of damage and means used for prevention, contributed from parishes in an area of seven miles radius round Leominster, and from six other districts in the county, are appended to this paper in tabulated form, with summary of information accompanying.—(Ed.)

DERBY.—Elvaston. The Turnip Fly was unusually troublesome during the summer of 1881. Most farmers had to sow twice, and not a few even a third time; consequently the crop throughout the Midland Counties was late, and, although the autumn has been particularly favourable, it is generally under an average.—(G. M.)

STAFFORD.—Standeford, Wolverhampton. We are not troubled very much if due care is taken in getting the land in good tilth, and a little artificial manure used. The Turnips are this year exceptionally good in this county.—(R. P.)

CHESHIRE.—Sandbach. On the whole the fly was only troublesome for a short time. The Whites sown before the third week in May were never attacked. Those between that time and the second week in June had to be resown as a whole, and after that there was little to complain of.—(G. W. L.)

LANCASHIRE. — Turnip Fly never distresses us much in West Lancashire. Swedes are generally grown, and, though the seed-leaves are more or less riddled by the flea-beetle, sufficient plants get away, favoured by the moist climate, to establish a good crop when thinned.—(W. W.)

WALES.

The following are the only notes I have received from the Principality:—

BRECON.—Nantyrhairn. This year my crop entirely escaped, and I cannot complain of any material loss for several years. I believe that well-cultivated farms, as a rule, are less subject to the ravages of the Turnip Fly. I have also found that early sowings are more subject to the attack of the fly, and I do not believe in sowing Swedes

before the 20th of May, or even the following week, should the weather permit.—(O. P.)

Penpont Farm, Brecon. The pest did considerable damage in this neighbourhood in the season of 1881 in several places; of fields sown precisely at the same time, some escaped with little or no damage, whilst others were completely spoilt. Of six acres under Turnips, I had four completely spoilt.—(T. J.)

SCOTLAND.

The following returns begin with the southern counties bordering on England, and proceed northward:—

Dumfries and Kirkcudbright.—The evil caused by the Turnip Fly in the southern counties of Scotland this season is nothing short of a national calamity. Scarcely one field of Turnips escaped throughout the counties of Dumfries and Kirkcudbright, and in many cases seed had to be sown a third, and even a fourth, time. "We had, during three weeks in May, an unusually high temperature, with very clear sunny days. This gave the beetle a start, and the cold sunless weather of June and July never checked it. If the Turnips had been growing in June and July, as they do in an ordinary season, they would have grown out of harm's way; as it was the beetles overpowered them, eating them off the face of the earth." Taking an estimate (see acreage of counties of Dumfries and Kirkcudbright) believed to be very much below the real loss, it may be calculated that 80,000 acres in the two counties have this last spring required to be sown a second time owing to the ravages of the fly, and estimating four pounds to the acre as the average quantity sown, and 9*d.* per pound as the price, shows a loss in the single item of seed of £4500. The main result here (putting aside loss of money) is that there will scarcely be one-fourth of the usual quantity of Swede Turnips, for the resowings were mostly done with Whites and Yellows.—(R. S.)

Selkirk.—From near Selkirk. This has been by far the worst year with the fly in my experience. Swedes, more or less, are attacked every year, but with thick sowing (about four pounds per acre) they generally survive; but this year they are almost a total failure in this district.—(J. G.)

Roxburgh.—Branxholme, Hawick. We all suffered very severely this season, some having to sow Turnips three times over; but the weather has since been favourable, and on the whole we shall have a fair crop hereabouts.—(W. E. L.)

Berwick.—Marchmont Dunse. In Berwickshire, where a large breadth of Turnips are grown for cattle and sheep, the destruction to the young plants by the Turnip Fly and frosty nights were such as to compel resowing in many instances three times. The early spring

months were unusually dry, the soil was friable, and required but little work to bring it to a fit state for receiving the seed, which in many cases was rather hurriedly put in to get clear of the work. No rain fell from the 21st of May to the 10th of June, and from the 28th of May to the 3rd of June the maximum thermometer read at 80°, 78° (three times), 74°, 71°, and 65°, where the following week the minimum thermometer fell on five mornings below the freezing-point, and on the 10th of June to 23° (that is, nine degrees of frost). Young Turnips were weak where they were not killed, and easily fell a prey to the vast numbers of fly—in fact whole fields were eaten up in a few days' time. The insects had it all their own way until the heavy rainfall of the 16th and 17th of June, and (though late) sowing still took place on several farms, in hope of obtaining at least part of a crop; nothing seemed to stop the ravages of the fly; but the rain, ten tons and fourteen tons per acre, had no perceptible effect, and not till we had a fall equal to fifty-eight tons on the 16th and forty-eight tons on the 17th, did the last of them disappear.*—(P. L.)

Earlston. The Turnip Fly (*Phyllotreta undulata*) has done much injury. It began to get numerous in the first week in June, and continued until nearly the end of July. Whole fields were destroyed, and had to be resown, in a few cases three or four times; and it is observed that it is not so much in the expense of resowing that the loss is felt, as in the plants being so backward that they never get to any size.—(R. R.)

Haddington. In the matter of the Turnip Fly our farmers have lost very largely this year. I know many cases where second and third sowings have been resorted to, and yet the crop is far below the average; and, as a result of the ravages of the fly, Swedes are very scarce with us this season,—not that the fly prefers them to White or Yellow Turnips, but by being first sown they are first ready for attack, and when eaten over it is, generally speaking, too late to sow the same kind again with the prospect of a full crop, and Whites or Yellows have to be substituted for them.—(W. D.)

Eaglescairnie. On application to the seedsmen of Haddington as to extra amount of Turnip seed sold for sowing during the past season, it is replied they have sold one-half more than the usual quantity; and from similar inquiries made in surrounding counties it appears they also have sold one-half more than usual. Taking the acreage under Swedes and Turnips in 1881 in Haddington in round numbers as 14,000 imperial acres (number of acres was rather more, 15,447, Ed.), and estimating half of these to have needed resowing, the rough estimate of loss to this county by fly in this season of 1881 would amount to £15,660 sterling.

* The rainfall of the 16th and 17th represent respectively rather more and rather less than a fall of half an inch on an acre of ground. A fall of one inch amounts to 101 tons per acre.—(Ed.).

7000 imperial acres at 4*s*. per acre for double seed	£1,400
,, ,, 40*s*. ,, for difference in value of produce of first and second sowing	£14,000
Horses' work, resowing	£260
	£15,660

In many cases Turnips had to be resown three times, and the above calculation is considered below the loss.—(F. M.)

Edinburgh.—Dalkeith. The hot weather at seed time brought on a rather severe attack of Turnip Fly, and many fields had to be sown twice over, and some three times. Where the first sowing escaped the fly the crop grew fast and turned out well; but cold and wet weather prevented the young plants making rapid growth after they were cut off the first time, so that the Turnip crop generally made little progress till the autumn,—(M. D.)

Fife.—Out of fifty-two acres this season I had to sow forty-four over again, and some even a third time. I estimate my loss at £4 per acre.—(D. H.)

Lanark. — Farmers at Johnstone, near Glasgow, were greatly troubled by this pest, some of them having to sow as often as three times.—J. M'K.

Argyle.—In the neighbourhood of Ardkinglas, near Inverary, the fly has done an infinite amount of damage, not a field (save one in a damp locality lying along the banks of the River Fyne) or garden for miles round having escaped its ravages.—(T. W.)

Isle of Mull.—Torloisk. Not a single instance of fly-attack on Turnips was seen or heard of in the fields during the season, the large amount of rainfall in June and July amounting, in June to 5 in., and in July to 8·80 in., having forced the plants into the rough leaf very fast. A few early-sown Turnips in the garden were badly attacked by fly (*Phyllotreta undulata*), but a few dustings with soot saved the crop, and the latter sowings were not touched.—(C. G.)

Perth.—Abercairny. This district suffered like most others, equally badly, and no remedy, to my knowledge, was tried by farmers farther than to depend on a return of moist weather and resowing. I have no doubt, owing to a continuance of frosty nights during the time the plants were in their critical stage, that in a good many districts they suffered much from the frost, and fell an easier victim to the fly. After twice sowing, and, in some cases, three times, we are likely to have a fair crop of Turnips, but below the average.—(J. B.)

Colenden, Stormontfield. Some farmers have had to sow a second and even a third time before a good braird could be well established. —(R. C.)

Caithness.— Watten. All the damage we in the North have

sustained, so far as I can learn, has been from weevil. I am afraid not a few are putting down to *Haltica* that which has been done by *Ceutorhynchus contractus*.*—(G. B.)

The Turnip Fly is scarcely ever seen in Orkney.—(T. M'D.)

IRELAND.

The following notes are the only contributions received from Ireland relatively to amount of attack; the others refer chiefly to methods of cultivation:—

ANTRIM.—In the Glenarm district fly is reported to have never proved more disastrous to the Turnip-crop than in the season of 1881, as in some cases the seed had to be resown three times, and there was only an inferior produce after all. The average produce is estimated at one-sixth of what it should have been.—(T. B.)

Randalstown. In this neighbourhood, near the shore of Lough Neagh, we have usually an abundant supply of moisture, and good crops of Turnips when the land is well farmed. This year several farmers have had to resow owing to the havoc the fly made.—(J. M.)

The preceding pages convey some information as to the extent and amount of Turnip Fly-attack in England and Scotland; and in the following, under the headings of Cultivation, Seed, &c., the information is given with which I have been favoured regarding methods of treatment that have been found of service in prevention or remedy of attack. It may possibly be objected that there is too much repetition, but by thus reiterating the same advice or the same opinion from many different contributors we obtain a mass of evidence we could get no other way. One by one, from different soils, from different situations of hill or lowland, or circumstances of climate involving differences of temperature and of amount of moisture, we have the opinions—in many cases giving the long experience of some of our best agriculturists—that the ravages of this destructive pest *can* be much diminished by measures lying in the ordinary means of cultivation, and that it is to these we must look for all solid hope of prevention. Dressings of the seed may sometimes be of service; dressings on the plants, rolling, brushing, or other methods of treatment, when the fly-attack is present, may also be of service; in many cases, and especially in garden cultivation, they are shown to be so, but what we have to look to for safety in ordinary years, or help us to carry a fair amount at least of the plants through attack in bad

* See special account of injury by this insect (forwarded with specimens accompanying) under head of "Weevil" (*C. contractus*).

years, is sound agricultural practice, based on knowledge of the wants of the Turnip plant, and of the habits of the Turnip Fly.

The Turnip is very succulent, and needs plenty of food and moisture, and moderate warmth to press on growth; and the attacks of the Turnip Fly are most serious in heat and drought, for in such weather the "fly" or "flea" beetles propagate more freely, and use their wings, and consequently spread further; also heat and drought together keep back the growth of the plants, which are therefore exposed for a longer time to fly-ravage. Frost, or cold with drought, or cold with rain, or any kind of weather or circumstances that are unfavourable to plant-growth, also throw the crop under the power of this pest; but heat and drought are the worst, because they are good for the fly as well as bad for the plant.

In many of the following notes it will be observed that it is advised, by autumn cultivation (where this is practicable), or by working the land as early in the spring as it can be done, to preserve the moisture that has accumulated during the winter for the benefit of the germinating plants. By thus preparing the soil beforehand, little stirring of the ground is needed when the time comes for seed-sowing; and, instead of the land being repeatedly thrown open to (what is often at sowing-time) a drying sun and air until the surface moisture is completely dried out, the application of the use of cultivators or scarifiers, which expose little fresh soil, is enough. The surface of the ground, which has been mellowed by exposure to frost, or weather influences, gives a fine tilth suitable for germination, retains moisture evenly, and gives it out gradually and genially for plant-growth. The most favourable conditions are thus secured for the germinating crop, and there is the further advantage that where the land has thus been well cleaned and cultivated beforehand there will have been all the less food and shelter for the fly in winter and spring, and consequently less risk of attack.

What is the reason of the attack of 1881 we do not know with certainty; but looking at the way in which this pest infests Charlock, and spreads from it even in common seasons, and considering the quantity of this weed that followed on the wet season of 1879, together with the impossibility, after that wet, of giving the land the thorough cleaning needed to keep down the fly; such conditions point to the attack being fostered during 1880, and breaking out in unusual numbers when favoured by the unusual heat of the early summer of 1881, which was just suitable for its increase. The following notes refer mainly to this point:—

CHARLOCK.

Observations regarding prevalence of Charlock after wet seasons, and of large amount of attack of Turnip Fly in the year following a large Charlock crop, methods of eradicating Charlock, &c.:—

Bradford-Abbas, Dorset. As it turned out my farm was overrun with Charlock, the legacies of the last wet seasons; it came up in the Barley so thick that I expected the farm to look like a Colza-field; but, strange to say, the "fleas" attacked these gay plants of Charlock, and so completely destroyed it that there is now scarcely any Charlock on the farm. A more complete clearance of a pest than they made I never knew. Having done their work they went away, and my Swedes, sown late, escaped their visitation. These were fairly good, eighteen tons to the acre. I fortunately had not to sow a second time, but they were late, or the crop would have been larger if the flea had not taken them.—(J. B.)

There appears to be a clear connection between a prolific Charlock crop and a fatal fly-attack succeeding it the next year. 1880 was without doubt most remarkable for Charlock, so much so, in fact, that many cereal crops on these Hampshire Hills were entirely choked with it, so that many pieces of corn were not worth cutting. The soil on my farm (West Worldham, near Alton, Hants) lies upon the peculiar and rare "malm" or upper greensand, and, singularly, never suffers severely from Turnip Fly, possibly because this soil is not particularly favourable to Charlock. Another reason may be that it is capable of such trituration that our Turnip tilths are like beds of flour (almost as fine and white as common meal), and afford no cover to this insect, which revels amongst clods; a further cause may be the liberal use of lime.—(D. T).

It is only fair to the Turnip Fly to say that it has this year done much good in some districts in devouring Charlock. This weed is one of the farmer's greatest enemies, and annually causes great damage to the spring Corn-crops; this year the golden carpeting has not been seen, and this, I believe, must be placed to the credit of the Turnip Fly.—(R. S.)

Before the Turnips came up the "fly" cleared whole fields of Charlock in this neighbourhood (St. Albans).—(F. S.)

From observations in past years there can be little doubt but that prevalence of Charlock and other weeds of the Cabbage kind in the white crops have a direct influence on the amount of presence of fly in the green crops following. It has often been noticed, when Charlock was abundant on any part of a field, that it was on this spot that fly-attack began, and also that hedges and other surroundings, where weeds of this and similar kinds are allowed to grow

neglected and unchecked, are spots from which the fly comes forth and spreads over the crop; anything, therefore, that would keep down or destroy these weeds would be a great preventive of fly-attack.

Charlock being very hard to get rid of, various plans have been tried with more or less success, such as growing Potatoes after lea, to be followed by Turnips, which allows the weeds to be kept thoroughly down for two years in succession; but the best means within the ordinary course of cropping is to harrow the stubble immediately after the Corn crop has been removed, to induce the germination of the seeds of all the weeds. The ploughing afterwards (which is postponed as long as possible) will then destroy the first crop. In spring the soil is again worked up, and left for a time, when a second growth is killed by passing a pair of harrows over the ground on a dry sunny day. An implement called a K has also been found serviceable. Here the Charlock is allowed to come into flower, when the implement, with its comb-like teeth, pulls off the flower, or pulls the plant up by the root, and leaves the grain-crop untouched.—(G. B.)

CULTIVATION.

Methods of cultivation found most suitable for pushing on healthy, rapid growth of the plant, and so carrying it from under power of the fly.

It is well known that want of moisture is the great promoting cause of injury by the fly. Next to this is a rough, badly-prepared soil in poor manurial condition.

Autumn cultivation should be aimed at as much as possible. Land intended for Turnips should not require any ploughing in spring, and as little scarifying as possible. A few hundredweights of good artificial manure, applied either before or when the seed is sown, promotes a strong and rapid growth of the braird until it gets into rough leaf, when danger from the "fly" is over.

After a long experience I never saw a failure of a braird of Turnips on land which had been long and well-prepared before the seed was sown. Good seed and plenty of it, three pounds per acre, drilled deeply from (say) two to three inches, ensures a good start, even in the driest times.

The application of soot, lime, nitrate of soda, or guano does much to save a crop (although much bitten by the fly) when a suitable rain follows, or when the land has been well moistened by a previous rain. Rapid growth is of course the great aim under any varying circumstances.—(R. V.)

A finely comminuted soil is of the greatest importance. On strong land autumn cultivation is essential; such soils, when ploughed immediately before sowing, invariably work cloddy. At this season

evaporation proceeds rapidly, and the moisture is soon dissipated; hence vegetation takes place slowly and unevenly, and the young plants are eaten off as they appear.

When the land is manured and receives a deep furrow during dry weather in autumn, the ameliorating effects of the winter's rain and frosts reduce the surface to a fine tilth, and a shallow scuffling, to destroy the growth of annual weeds before sowing, preserves the moisture, insuring a rapid growth of the young plants.

On the best Turnip land of the Midland Counties we prefer the ridge system of cultivation. The land, when reduced to a fine tilth, is ridged, the farmyard and artificial are applied, and at once covered in, and the seed immediately sown, whilst the soil is still fresh, on ridges twenty-seven inches apart. We never use less than three pounds of seed; we have always found thick seeding a great preventive against the inroads of the fly. Even when large quantities of farmyard manure are available, we prefer an addition of two to three hundredweight of artificial manures per acre, which rapidly pushes the plant through the time of its first leaves, or cotyledonous stage. In the chalks and drier climate of the south we prefer sowing on the flat; here we have found the water-drill of great use in giving the young plants a speedy start in trying seasons. Great injury is often done by rolling the land before the surface is quite dry, and thus forming a crust, through which the young plants have great difficulty in forcing their way. In short, a fine tilth, plenty of seed sown at once before the moisture has time to evaporate, the land lightly rolled, and the use of a fair quantity of phosphate manures are, in our experience, the best antidotes against the attacks of the Turnip Fly.—(G. M.)

The Turnip Fly seldom attacks Turnips and the like severely enough to destroy them when they are sown on a "stale" fallow (that is, on land ploughed in the autumn and laid as fallow during the winter and spring following), free from weeds and in a friable state, and are drilled in with superphosphate. Those suffer most that are drilled in after a previous green crop, such as Rye, Winter Oats, Vetches, &c. Early-sown crops generally suffer most. We seldom suffer (locality Mere, Wiltshire, Ed.) to any extent after midsummer. This year early Turnips, Rape, &c., were almost annihilated, but since the first week in June nothing has been seen of the fly; and on our Wiltshire hills we never suffer so much as in the valleys.—(T. B.)

As far as my experience goes, the fly does not go on stale mould as badly as on freshly turned-up soil, and is not very troublesome if the wintered or frosted mould is kept for the seed-bed. I have known the fly begin on one side of the field and spread rapidly over it, but I have never known them in anything like this quantity on stale

ground (or what may be called Nature's seed-bed). Where land has to be cleaned in the spring, and large breadths grown, small remedies are unavailing.—(C. C.)

I believe the surest way to prevent fly-attack is to have the land well and continually cultivated to bring it to the finest tilth, to keep it free from weeds as long as possible before sowing, and to use the water-drill with superphosphate, or other manure suitable to the land, having little rakes behind each drill-coulter to rake some dry loose mould over the water to keep in the moisture. Whenever I could adopt this plan I have rarely lost a plant by fly; but in farming such a condition of things as I have described cannot always be obtained.—(W. J. E.)

I am now more inclined to think that effort ought rather to be directed to prevention than cure by trying to secure the most rapid early growth of the young plant that can be possibly be attained, and I have found, from a number of experiments, that mineral superphosphate of lime, four hundredweights to the acre, gives the quickest braird as a rule.—(J. E.)

I am not aware that different kinds of manure either increase or diminish the liability to the fly, but undoubtedly soils that are peculiarly adapted for Turnip growing, which have been dressed with farmyard-dung in autumn, then ploughed, and, when sowing-time arrives, are found to be clean, so that the work of preparing for sowing does not expose or re-expose the soil to the drought (so that the drills are at once made with slight previous cultivation), a liberal supply of requisite manure, and the seed sown in a fine seed-bed, are the conditions most likely to force on the young seedlings to their rough leaf, and enable them to escape the fly.—(F. M.)

Escrick, York. Our light sand has such capillary power that we seldom lose the plants, although they were very much tried for a few days. Fineness of soil, and securing all the moisture that is possible by drilling up every day, seem the most neeessary points in our case. —(J. C).

I find the best plan for obviating the trouble from Turnip Fly is never to plough in spring; only cultivate, which keeps the moisture in the land, and the Turnips grow more vigorously.—(J. S.)

(From Limber, Lincolnshire, on the North Wolds, a stretch of chalk hills extending south from Barton-on-the-Humber, the soil at the locality varying from sand to good sandy loam overlying the chalk.) On the Wolds the difficulty the fly makes is this: we can grow splendid crops of Turnips if we do not miss "the season," but this is often of short duration, and, if the fly comes at the critical time, the chance of a good crop is very small. Wold-land is troublesome for weeds, and those who manage it in such a manner as to keep it clean

without having to knock it about too much in a *dry hot time*, have much less trouble with the fly than those who give extra ploughing, harrowing, &c., thinking to make a good use of the opportunity to get their land clean. When land is in good condition, well managed, and liberally manured, and the seed sown thickly, the plant will generally get into rough leaf in spite of the fly, and grow so quickly as to defy its attack.—(T. H.)

It is very desirable to work the land well, and get it fine and moderately close, keeping in the moisture as much as possible, at the same time stimulating the young plants with superphosphate or other Turnip manures.—(B. B.)

TILTH.—A fine tilth is most desirable; the parts of a field first hopelessly injured are those where the surface is the roughest, the small clods causing the moisture to dry out more quickly, and affording shelter for the fly from breezes which they do not like. All the preventives I have seen applied either to the seed or to the crop when attacked have been total failures.—(T. H.)

Good tilth and condition are the chief auxiliaries to push the plant out of the way of the fly.—(J. B. J.)

The finer tilth that can be got before sowing the better, and as to manure, I should recommend a liberal supply of whatever kind is used.—(W. H.)

I should add, as to the Turnip Fly, the finer the tilth the less are its ravages.—(C. H.)

I know of no remedy, but like to have my land in fine condition and well-manured, so that the plant may make the best use of its time in getting out of the way of the pest.—(R. S.)

As a rule ground is not sufficiently worked for root-crops, as, when hot dry weather sets in, the soil gets hard, and it is with difficulty the ground is brought into a good condition to receive the seed. I think the finer the tilth the better for all small seeds.—(A. S.)

I have always seen that the finer the ground is got before cultivation the quicker the plants come away, and the better and faster they grow out of the way of the fly.—(R. R.)

I think it is best to hoe as soon as the drills of seed can be seen, which will be much sooner if the tilth is fine, which I consider very necessary for all small seeds.—(T. J. M.)

SEED.

The importance of thick sowing strongly brought forward. Observations given of it having been found serviceable to sow seeds of various ages, so that some of the plants may be likely to escape the fly. Mixture of a small quantity of Mustard with the Turnip seed is mentioned as being of use on account of the preference of the fly for the Mustard plant, which thus attracts it from the Turnips. Observations on early sowing; also on sowing in weather suitable for germination, avoiding extremes of wet, or soil clogged thereby, as well as drought.

Unless the season is very favourable, I should prefer a *thick seeding*, as I have invariably found the rank-sown drills to do better than the thin, where the "flea" was numerous. As to the capabilities of the different varieties of Turnip and Swede to withstand the attack, I have found Turnips, as a rule, better than Swedes, and the somewhat coarse but hardy and vigorous variety of Swede raised in the north to stand the attack better than the varieties of finer quality.—(W. H.)

My only practical remedy was *thick sowing*.—(R. S. S.)

I have generally found *thick sowing* to stand better than thin, but this year the flea-beetles appear to be in much greater numbers, and stronger insects than usual, so that nothing will stand out against them.—(D. H.)

Very thick sowing is a great advantage, so that there may be plenty of plants to allow of many being eaten. We sow here (Eaglescairnie-Mains, Haddington), five pounds per imperial acre; but I observed this year, where the lad had left the stopper out of the seed-barrel, and had sown a few yards extraordinarily thick, the fly was not able to eat them all, and consequently plants were obtained for a crop.—(F. M.)

I think the best preventive of the Turnip Fly is to *sow plenty of seed*, because the thicker the seed the quicker it germinates; after the plant gets to a certain size the fly cannot hurt it; also to have the land worked as fine as possible.—(J. W.)

I fear the only remedy will be to feed our enemies by *thick sowing*. On this farm (Fans, Earlston, N.B.) sowing was commenced on one field on the 12th of May, and finished on the 14th, and, by way of trial, eight drills were sown at the rate of nine pounds per acre of Swede seed, and the rest of the field was sown with five pounds per acre of the same seed. The eight drills were thinned on the 20th of June, but part of the field sown with five pounds per acre was not ready until the 4th of July, and the rest of this part had to be resown. On the 2nd of November the crop on the drills sown at the rate of nine pounds was estimated as worth £4 or £5 per acre more than the part

sown with five pounds, and all sown at the same time, and with the same treatment.—(R. R.)

On a farm in the neighbourhood of Sunderland, Durham, where fifty to sixty acres are grown annually and a good plant is rarely missed, *six pounds of seed* are used per acre (three pounds being the quantity commonly thought sufficient). Of course the plants require to be thinned when very small, or else they would soon get "spindly" and spoil.—(Communicated by J. S.)

MIXTURE OF VARIOUS AGES OF SEED.—It is a good plan to sow a *mixture* of one, two, and three years' old seed, as the fly is not likely to attack all the growths.—(F. S.)

I always recommend farmers to sow a *mixture of old and new seeds* in this way, the old seed, being longer in springing, a successive crop comes up if the first is eaten over. I have known many cases in which this has proved successful, especially if rain followed, which would make the ground unfit for working, and thus prevent second sowing for (say) a week or ten days.*—(W. D.)

MIXTURE OF MUSTARD WITH TURNIP SEED.—I believe fully in the old custom of sowing *Mustard* seed with the Turnip seed (either drilled in or broadcast) as a preventive. The Mustard appears a few days before the Turnip, and is pounced on ravenously by the fly in preference, and in most seasons sufficiently protects the Turnip plant. This year, however, Mustard and Turnip were grazed off and totally ruined by the fly in these parts.—(J. H. A.)

I always put plenty of seed, and put a little *Mustard* with it; the Mustard grows faster than the Swede, and, as the fly always goes on the higher plant, we therefore find it on the top of the Mustard by preference to the Swede crop.—(C. C.)

The use of *Mustard* is also alluded to in the following note from the 'Journal of Horticulture' for Sept. 22nd, 1881, to which my attention has been drawn by several contributors.—ED.):—

"I noticed, in a market-garden to-day, what was to me a novel remedy. . . . A central line of *Mustard*, with seedling Cabbages, Cauliflowers, and Broccoli on one side and various Turnips on the other, all without a leaf touched. I understand this is a perfect remedy."—(N. J. M. C.)

* With regard to the importance of sowing *good* and *reliable* seed, a correspondent draws attention to a difficulty which is very likely to arise in outlying districts where seed supplies run short, or where the necessity of using good seed to secure rapid germination is not enough considered; this is, that in years when farmers have again and again to resow their Turnip seed, inferior or old seed is liable to be offered at reduced rates, which many purchase and sow. This is a subject on which good agriculturists would need no hints, but in some cases the deficient quality of seed would explain non-appearance of the plant.—ED.

ON SOWING EARLY IN NORTHERN DISTRICTS; AND IN MOIST WEATHER,

(From upland-ground, Ayrshire.) I consider that the proper method of prevention consists in bringing the young plants quickly on to development of the rough leaves, and, as a measure to this, that there is nothing like early sowing. I have never seen the early sowing fail to produce a crop on such amount of land as I have annually to do with on an upland farm in Ayrshire, where we have been in the habit for many years of sowing our Swedes and Turnips of all kinds in the latter end of April or beginning of May, and (in consequence) we have never been troubled with the "flea," although—this year, for instance—our neighbours all round about who sow later on have had to resow two or three times. I estimate the crop at above thirty tons per acre. This early sowing gives the plant time to develop its rough leaves before the beetles appear in sufficient numbers to do harm, and the Turnips yield all the better crop from the longer time they occupy the ground. I am aware, of course, that early sowing would not suit southern districts, where again early-sown Turnips tend to run to seed, especially the softer varieties; but, if good seed is used, there is no danger on this score. We ourselves have never been troubled with an undue quantity of "shot" Turnips.—P. M'C.)

Ballinacourte, Tipperary. Sowing early, where practicable, and in such weather as would force the plant quickest into the rough leaf, that is immediately before or after rain, and the use at all times of plenty of seed, has been found successful.—(D. S. S.)

I am very particular never to let horses go on the land in spring when it is wet, and always like to let the land lay still for ten days before sowing; we run a skim through and drill when the land is quite dry *at the top*, using a good dressing of artificial manures and bones. I have noticed people drilling Turnips when the land was wet, and generally found that they suffered from the fly, unless the weather was showery for a week or so after. I have always thought the best preventive against the ravages of the fly is not to sow till you have a good season, nor before about the last week in May, and use a good dressing of phosphates, &c.—(E. R.)

I have never seen the fly so ravenous in either very early or very late sowings as in the medium, say from the middle to the end of May. —(L. P. O.)

STEEPS FOR SEED.

Opinions as to serviceableness or unserviceableness of damping or dressing seed before sowing, and notes regarding experiments with turpentine, paraffin oil; oil and petroleum (observations of the use of crystal oil, with sulphur dusted afterwards, on the seed,—and of carbolic powder with sulphur and soot drilled with the seed,—are given in the tables of returns from Herefordshire).

Some farmers damp the seed before sowing with turpentine, paraffin oil, or other strong-smelling fluid, or mix the seed with various powders; but none of these measures seem to have much effect in stopping the ravages of the little pest.—(W. H.)

I have tried dressing the seed with *turpentine*, but cannot say positively with any decided effect.—(F. S.)

Mottisfont, Romsey. Having heard at Romsey Market, and again at Andover Market, that, by the application of *spirits of turpentine* to Turnip and Swede seed, the parties using it had secured a good plant of those roots for several consecutive years, I tried the experiment myself on nine acres. On June 11th, 1881, twenty-seven pounds of what proved to be a mixture of Swede and Turnip seed was placed in two galvanised buckets, and four ounces of spirits of turpentine was poured into each, the seed being then turned thoroughly many times. Three days after (June 14th) the seeds were drilled at the rate of three pounds per acre, together with a mixture of screened chalk and sand at the rate of fifty bushels per acre. The seeds germinated well and quickly, and the plants certainly were free of the Turnip Flea for the first two or three days after coming up. After these first few days of freedom the flea appeared in very great numbers on the leaves, and attacked them heartily, but the Turnips and Swedes grew away from them. On June 27th flat-hoeing between the drills was begun in this piece, horse-hoeing on July 9th, and on July 11th we commenced singling out the plants. The result gives a very good piece of roots throughout the nine acres. Rightly or wrongly, I attach great importance to the fact of my having used spirits of turpentine, and I intend to continue the practice.—(G. A.)

Dressing the seed before sowing with pure *paraffin oil* has been found to have a good effect in preventing attack of fly and hastening growth of young seedlings.—(F. M.)

A second sowing of Swedes at Langleybury, Herts, steeped in *paraffin oil* was a good plant, but the flea-beetle took them in patches on the highest ground, which was a little foul at the breaking up. —(A. S.)

I have tried steeping the seed in *oil*, &c., and, although I found

some advantage, I also found that the difficulty of distribution was much increased by the altered condition of the seed.—(J. T.)

Have heard that it is a safeguard to use half a gill of petroleum to wet ten pounds of Turnip or Rape seed, but only tried with the last sowing; and as others that sowed at the same time and did not use it had a good plant as well as myself, I cannot say that it is a preventive.*—(T. J. M.)

IMPORTANCE OF A GOOD START TO THE PLANT, AND EFFECT OF MOISTURE, &c.

Reasons why fly-ravage is worst in drought. Observations of watering being of service, with difference of weight a fortnight after germination of watered and unwatered plants. Beneficial to sow in damp ground, and immediately on it being ready. Importance of stimulating the first growth by all means, including drilling manure with the seed, or use of liquid manure drill. Water-drill noted as (in a general way) starting the Turnips so that they are fit to single a week sooner than by the use of the dry-drill; but most serviceable in moist seasons, the small quantity of water applied being in dry seasons liable to start germination, which afterwards may perish from drought. Use in garden cultivation of watering with solutions of soft-soap, and very weak paraffined-water.

Anything that would *accelerate vegetation* would be the best means of saving the crop, but the reason the fly is so destructive on bright

* As far as experience shows at present, the prevention of fly-attack on the young plant, by previous use of steeps to the seed, is an uncertain matter, and, in cases where good results have occurred, we do not know clearly (if they were the direct *result* of the application) in what way the application worked. It is open to *possibility* that in the case of some of the steeps the application in dilute form may be absorbed into the tissues of the young plant to a sufficient degree to affect its taste to the insect that feeds on it. In the case of experiment made by myself (Trans. Ent. Soc. Lond., 1878, Part iv., p. 333), as to absorption of phenol preparations, it was found on analysis (by Messrs. Savory and Moore) that a minute quantity of a tarry volatile substance was present in the Carrot roots that had been watered with the dilute preparation; and if, by analysis of young Turnip plants from steeped seed, the presence of matter from the steep could either be proved or *disproved* satisfactorily, it would be a useful step. The point that seems more likely, however, is that the scent of the dressing so affects the land by coming up through the light surface-soil as to make it temporarily unpleasant to the fly. This would be quite reconcilable with the very different experiences on this subject, for the amount of smell would differ very much according to circumstances, such as dry heat, which would evaporate it strongly and rapidly round the germinating plant, or rain, which would drive the surface together, &c. If we could have notes with exact detail of the nature and the amount of steep used, nature of soil, condition of ground at time of sowing, and weather immediately following, we should see our way very much better.—Ed.

hot days is because half-a-dozen bites on the first smooth leaves of the Turnip plant wound them so much that the scorching rays of the sun shrivel the plant quickly and completely, whereas, if the days were cool and cloudy, the plant might survive long enough to enable it to throw out the rough leaves, which the fly will not attack so freely.—(T. H.)

In moist weather the flea is comparatively harmless; it is when dry parching weather sets in, just as the Turnips break ground, that the attack is most to be dreaded. In such cases I am of opinion that a frequent use of the *water-cart* is the best thing to do.—(W. H.)

In the garden, on a small scale, I have found *watering daily* to be a great preventive to the ravages of the flea-beetle, as also dry wood-ashes or road-dust thrown over the plant until it is strong enough to withstand the attack.—(A. S.)

With regard to precise effect of watering on the germinating plant, I can state, from such experiment as I have been able to make, that at the end of a fortnight from their appearance above ground, the plants from a patch of Turnips which had been watered (in a season of drought) on either two or three evenings, *weighed one quarter* or rather more than the plants from precisely the same measure of ground close by, and in exactly the same circumstances, excepting that they had not been watered.—(Ed.)

I think that *surface moisture* is a good preventive, and that the seed ought to be sown *as soon after the ground is prepared* for its reception as can be, and the land not allowed to get dried.—(T. B.)

In the neighbourhood of Ardkinglas, Inverary, only one field is noted to have escaped ravage of Turnip Fly for miles round. This one field was a stubble, and in a damp locality lying along the banks of the River Fyne, with high-lying fields opposite. It was not ploughed till shortly before sowing, a fine and *moderately damp mould* was turned up, the seed was *immediately sown*, and a fine braird and crop followed. Several instances of resowing proved abortive, but wherever the drills were well harrowed down and set up by the common single-plough, fewer failures occurred.—(T. W.)

I observed two peculiar facts, *viz.*, that in a corner shaded by a wood the Turnips were not eaten off; again, that on the drills *surrounding a manure-heap* the same was the case.—(A. S. A,)

The great danger is when the Turnips are in the smooth leaf. By forcing them (naturally or artificially) quickly into the rough leaf, the attack may be warded off.—(W. R. S.)

The first requisite is to fight the enemy with a *good supply of manure*, so that the young plant may get out of his reach as soon as possible.—(J. T.)

A small quantity of *stimulating manure*, such as a half-hundredweight

of nitrate of soda per acre, sown along with the seed, combined with thick sowing, forces the plant on till past danger, and the stimulant, becoming soon exhausted, does not injure the crop afterwards. I believe that liquid manure drilled in would have the same effect.—(P. M'C.)

As to the effect of sowing in dry seasons with the *water-drill*, I have always found the water-drill most successful in moist seasons. When the land is very dry, the amount of water put in by a water-drill is not sufficient to be of any service to the Turnip plant, and sometimes it is sufficient to cause the seed to germinate, and then, if rain does not come, it dries up or malts in the land. I have always, in a general way, found the water-drill starts the Turnips much quicker than the dry-drill, and they generally are fit to single out a week earlier than if sown by dry-drill.—(T. H. B.)

In garden cultivation "I watered with a good strong solution of *black-soap* three afternoons in succession, and found that the pest was gone. Later on, when the main garden crop sown early in June was attacked, an application of very weak paraffined-water was made, and this cleared the fly."—(J. M'K.)

In garden cultivation it has succeeded to have the plot of Turnips infested by fly run over, by means of a watering-can, with *soft-soap* suds. The application was made about four times, and in the morning and evening.—T. B.)

DRESSINGS AS A REMEDY FOR FLY-ATTACKS.

Notes of such applications proving of little use; notes of beneficial application of lime; lime and soot, or lime and wood-ashes; gypsum, or gas-lime; also spent hops and salt. Attention is drawn to the importance of sprinkling the lime at night, or in the early morning, when the dew is on the leaf, so that the powder may adhere.

I have only tried (*and given up*) the ordinary mixtures, of which gas-lime and soot are usually the principal ingredients.—(J. E.)

Elvaston, Derbyshire. We have tried quick-lime, soot, and other artificial dressings with *no very beneficial results*.—(G. M.)

Bradford Estates, near Shifnal. On June 3rd the Turnip and Cabbage crops were fast going with the fly. Dusting with *quick-lime* and *wood-ashes* mixed was tried, and some of the Turnips (those that were beginning to come into rough leaf) were thus saved; the others that were just brairding were so severely attacked that they had to be resown.—(J. C.)

In the neighbourhood of Ormskirk, Lancashire, where the Turnip Fly made its appearance, sprinkling the leaves with *powdered lime in*

the early morning, whilst the dew was on, proved beneficial—in fact, checked the attack.—(W. R. S.)

"A note is given of the roots being saved again and again by sowing (out of a seedlip) *freshly-slaked dust of lime* upon the plants as soon as up. The most effectual method is to do this *at night* when there is sufficient *dew* to fix the fine dust."—(Communicated by D. T.)

Lime is sown at dawn of day, so that it should adhere to the leaf whilst the *dew is abroad;* but if *spent Hops* can be readily procured, and the ground covered before the fly makes its appearance, it is a valuable aid, and protects the plant in its infancy.—(W. W. G.)

Where the plant is *watered*, and dusted with *cooled or partially-cooled lime* until the leaf is rough, the fly cannot hurt it much.—(J. S.)

In gardens the general remedy applied is dusting with soot and lime.—(J. B.)

Gypsum and Gas-lime.—My Turnips were attacked by fly when they were about two inches above ground; we dressed them with *gypsum*, which stopped the ravages of the insect, and the Turnips made good progress afterwards. Should my Turnips be attacked at any future time, I should apply the same remedy, having a good opinion of it for this purpose, and also as it acts as a manure. —(S. F.)

After a failure of Swedes through being eaten off by fly, a part of the ground resown with Yellow Turnips was again attacked, but some *gas-lime*, not long from the works, was powdered fine and gently sprinkled over the Turnips in the morning *before the dew was off*, which saved a fair crop.—(J. R.)

In garden cultivation I have found not perfect success, but mitigation of attack follow on sprinkling well with *gas-lime* that had been exposed for several weeks to the air.—(Ed.)

In one locality in the neighbourhood of St. Albans, where the fly-attack was noticed as severe on the Swedes early in the season, *salt* was at once applied broadcast at the rate of four hundredweight per acre, which at once cleared the fly, and a heavy and regular crop of Swedes ensued.—(F. S.)

VARIOUS METHODS OF DISTURBING, REMOVING, OR CATCHING THE TURNIP FLY.

Rolling; driving sheep through the infested plants when the dew is on; brushing with boughs.—The point of many of these applications being made when the dew is on *is very important, not only because under these circumstances the dressings adhere to the leaves, but also when the fly or flea beetle has its limbs clogged by moisture it cannot use its hind legs for its long flea-like jumps; consequently much larger numbers of fly remain in reach of the dressings.—Different method of using boards or canvas smeared with tar, or other sticky material, for catching the fly are also described.*

It is my invariable practice, when I see the plants attacked, at once to run a *light roll* over them. The operation is not pleasant to these troublesome insects.—(C. H.)

Rolling often saves a piece of Turnips; it dusts the young plants, and "firms" the soil to the injury of the fly, but to the benefit of the Turnips.—(W. J. E.)

A process which has been practised with marked success by various farmers in the neighbourhood of Ilminster is, when the plants have got their second leaf, and the fly has made its appearance, to *roll them* with a heavy horse-roller *between one and two o'clock of a summer's morning*, when it is just light enough to see where to go. In some cases the process has to be repeated at a fortnight's interval, but usually one rolling is enough.—(G. T. B.)

Driving Sheep.—From observations I found that the fly does not feed freely on dusty plants; so I have been in the habit of *driving a flock of sheep* over the field as soon as the plants appear. This I fonnd very beneficial, as, if done *early in the morning*, when there is a *little dew* on the young leaves, the fine dust adheres to them, and the fly will not feed on them until they have been washed. This remedy will not act in rainy weather, but neither does the fly then work, or if it does the plant soon outgrows the injury. If the sheep are driven about on the land more than once they will do no harm, only a few plants will be disturbed, This remedy is a very simple one, and I have certainly found it efficacious.—(J. T.)

Relatively to the same practice, I was favoured, in 1877, with the following communication:—

The field of Turnips I *drove sheep* over was thirty-seven acres; number of sheep, 400 to 500. I think by so doing I quite saved the plants, as the fly was then very strong on the young Turnips, then from four to five weeks old, and evidently meant to clear the lot. This is no new thing, as I have many times done so, and thereby saved the

crop, which is in no way injured by the treading. The only injury is to the sheep, as they are not willing to be treated so, and require a dog to be used to keep them together, and at the same time make them take all the ground in turn. We drive the sheep over part of the field one day and part another, as it does sheep harm to keep them long without food, and also to drive them early in the day; and this should be done at *five in the morning, when the dew is on the leaf.*—(R. P. T.)

Brushing the Plants with Boughs.—In the Thame district, Oxfordshire, the following plan was found successful in saving a good crop on one farm, whilst those around failed:—After the seed had been sown and was beginning to show out of the ground, the farmer employed a boy with a *thorn-bush*, who harrowed up and down the drills occasionally until the plants were strong enough to bear up against the fly. The bush-harrowing so disturbed them that they had not peace to get on with the destruction of the plants, and, so far as the crop was concerned, the light harrowing seemed to do no harm whatever.—(T. B,)

Elvaston, Derbyshire. We have several times saved the crop on ridges by having some *green boughs* drawn along their tops once or twice a day for several days; this dislodged the fly, and greatly curtailed the depredations.—(G. M.)

The plan of catching the fly- or flea-beetle by means of some viscid matter was recommended and practised by Professor Buckman many years ago, and in his excellent paper on insects which injure the Turnip crop, published in the 'Field,' June 26th. 1869, he gives the description of a machine for this purpose, simply made and easy to work. "It consisted of three light boards of sufficient united breadth to cover five rows of roots. These were banded together by two stouter cross-pieces fore and aft, the ends of which were formed into axles, on which ran low, turned wooden wheels." A pair of handles were fixed at one end, and the broad board on its wheels was so light that a boy could push it over the Turnips, "In this way we did as much as twenty acres a day in the dry summer of 1864, killing myriads of Turnip beetles and some two-winged flies, which were scraped off in masses from time to time, and fresh thin tar painted over the under part of the machine. By this means we saved our crop, when all around us failed."

In the notes I have been favoured with from Prof. Buckman, he mentions:—

I should have used the machine for the main crop this year, but from the cause stated I had no occasion to do so.—(J. B.)

The following method of clearing young plants of fly is the same as the above in principle, and is mentioned as serviceable:—

I nailed two boards together about twelve feet long and four

to seven inches wide, to the end of which I attached the small wheels of a three-furrow drill, and put some handles to it to push it along like a seed-barrow; some bagging was nailed on the flat board to be just above the ground; this was kept well-tarred, and, as it is pushed in front over the rows of young plants at a brisk pace, the fly, in jumping from the plant, comes in contact with the tarred bagging, and sticks there. Thousands may thus be soon caught, and a man can go over five or six acres twice in a day.—(C. C.)

A short note mentions fly being caught by wheeling a board to cover two rows painted with treacle or any sticky substance which the fly would adhere to, and thus be got rid of.—(F. W.)

The following plan, similar in principle to those above mentioned, but worked on a much larger scale, has been contributed, as mentioned by Prof. Allman to have succeeded:—

A large board, say the size of a dining-table, should be placed on wheels high enough just to clear the top of the Turnip drills. The under side of this board is to be covered with tar (pitch), and then dragged by horses over the field. The beetles naturally spring up and are caught in the tar.—(Communicated by R. S. S.)

The following observations show success to plants on well-cultivated land, with guano applied by means of the water-cart in dry weather; mention also is made of sea-weed as a manure.

From Lake Carra, near Killarney. Here, on a gravel (red sandstone) and peat soil, there are good Turnips with no "fly" either in Swedes or Aberdeens. These were on deep-ploughed ridges, on Potato-ridges of 1880, prepared by spade-labour; these 1880 beds put on the furrow of similar ridges of 1879, thus getting out stones to make way for its first ploughing in 1881. These were partly manured with well-rotted farm manure, cow-manure on furze bedding, partly with red sea-wrack (the kind used for "kelp," locally known as red-weed), and two bags of guano were watered, by means of the water-cart, on to the young Turnips in dry weather, which took root quickly and throve. Food-plants of fly were absent, the surroundings being mainly bogs, heath, trees, and Potato patches, and no wild Mustard.—(J. B. K.)

I have noticed beautiful fields of Turnips, where, in rotation with other crops, seaweed has been used.—(J. S.)

Observations regarding injury to promising plants on well-prepared ground by fly coming out of neglected surroundings; also of fly-attack being interrupted, and freedom from fly-attack occurring, respectively, at a portion of differently-manured ground.

I manured the whole (fifty-two acres) with farm-yard dung, sixteen cart-loads, and four hundredweights of artificial manure per acre. I got a splendid mould on the land,—a fine state for sowing, neither too wet nor too dry,—got good braird each time, but just to be devoured in a day or two. The insects seem to be worse where they get shelter. In one field, one-half Potato, the other Turnip, a number of drills next the Potatoes were entirely eaten off, not a single plant left; whilst the remainder gave about half a crop; and in another, where a dyke, hedge, and ditch run alongside, with a quantity of grass growing betwixt the hedge and dyke, a number of drills next this fence were similarly eaten off to those next the Potatoes. In another field a very peculiar incident happened:—Being four days in sowing it, on the fourth day I carted on the cotter's dung, and spread it in drills the same as the farm-yard dung, treating it the same as my own in every way, excepting that there was no addition to this of artificial manure, and it was cold, whereas my own was in a heated state; also I used the same seed. The first-sown part of the field was the first brairded, and also the first attacked by fly, and so on with each day; but when they came to the part manured with the cotter's dung they thinned the first drill; of the second they ate only a few, passed over the remainder, and attacked mine on the other side, and ate them to such an extent that I had to resow them, with most of the field. Now the cotter's few drills are a very good crop, whilst the rest is very blanky (on some acres not a Turnip), being eaten up by fly the second time. —(D. H.)

On a field of twenty acres of Swedes, one-half was drilled with manure and dissolved bones, the rest with dissolved bones only, and two ridges near the middle of the field with manure from a privy and ash-pit. The fly was troublesome on the whole field, but not so bad as to necessitate resowing, except the two ridges, on which they took every Turnip.—(W. S.)

At Goldsborough, Knaresborough, where it is observed by the contributor that he is not aware that he ever saw the fly so numerous before, a piece of Tares was noticed as gradually looking worse for three weeks, and on examination fly was found to be at work. There was not any weed noticeable in the field, certainly not Charlock, and when the Turnips adjoining got up (when the first-sown were about a week old) the fly appeared on them, and entirely left the Tares for the Turnips. From the condition of the Tares it appeared that the fly

had been on them during the greater part of April. Attack of fly to this crop is noticed as a circumstance never observed before, and that probably the fly would not have eaten the Tares if there had been anything else to be had.—(L. P. O.)

Haltica rufipes is noticed by Kaltenbach in his 'Pflanzen feinde' as infesting Tares, and this species of fly is also mentioned in 'Illus. Brit. Ent.' by J. F. Stephens as rather local, but found near York, and in Northumberland.—(Ed.)

HEREFORDSHIRE.

Summaries of Table and Reports.*

The following table contains information regarding attack of Turnip Fly in Herefordshire, together with methods of cultivation and other points of treatment found serviceable in prevention of this pest. The notes numbered 1 to 38 on this table have been contributed from parishes lying in a district of a radius of seven miles round Leominster, for the most part on alluvial or gravel soil, or, where this is not the case, on clay, or clay to loam.

Pages 89, 90, give fuller details from districts lying north, south, east, or west in Herefordshire, and, together with the foregoing, give a fair idea of the amount of attack in the county, and show that the same principles of cultivation are acted on that are recommended by good agriculturists elsewhere.

Nos. 1 to 38.—Working the ground early in the year, with various details of treatment to keep in moisture, is noted at Nos. 5, 10, 14.

The advantage of late sowing is noticed at Nos. 5, 9, 14, 24, 26, and 35; of thick seeding at Nos. 12, 15, 29, 37, and 38.

The use of Mustard in drawing off the fly-attack at No. 35; the desirableness of a fine seed-bed and sowing after rain at No. 38; and of a fine seed-bed, with forcing manures, at No. 12.

Light-rolling, frequent rolling as soon as the crop appears above ground, and rolling when the dew is on, are noticed at Nos. 3, 11, and 12; and liberal application of dissolved bones and frequent horse-hoeing, at No. 23.

With regard to steeps or dressings for seed, mention is made of crystal oil and dusting with sulphur, at No. 3; of paraffin having been found serviceable after some three years' trial, at No. 20; and of carbolic powder drilled along with flour of sulphur and soot with the seed, at No. 25.

Dressings of lime, also of soot, and of lime and soot mixed in equal parts, and applied as soon as the plants appear, are noted as desirable at Nos. 16 and 17; as also sprinkling with lime at No. 27; and lime and ashes, when the dew is on, at No. 30.

Absence of fly attack is noticed as occurring on the part of a field where there was burnt soil under, at No. 33; and the use of Elder-boughs fastened on scufflers for brushing away fly when the dew is on, at No. 2.

* The following notes of information are, by desire, given only with the names of the localities, not those of the senders, to whom I offer my thanks, together with my acknowledgments to Mr. J. H. Arkwright, of Hampton Court, Leominster, through whose valuable assistance I was favoured with the contributions.—Ed.

Reports from various districts (following the table) give notes regarding amount of attack; also of desirableness of good cultivation beforehand; and of such methods of treatment as may preserve the moisture in the soil at sowing-time.

Rolling to firm the soil is advised, and also a fine tilth, and the desirableness of an ample supply of seed is particularly dwelt on, as well as plenty of manure.

The importance of suitable weather and state of ground at sowing-time is shown by the difference in crop consequent on this in the different parts of a field treated alike, except in difference of one or two days in date of sowing. (This point, which is very important, is worked out more at length in the table of information from Boroughbridge, York, Ed.)

The use of Mustard to attract the fly from the Turnips, as mentioned at p. 71, and of a machine of boards drawn over the field freshly painted at each turn, so as to catch the fly in springing from the plant, similar in principle to the tarred boards noticed at p. 81, is also noted as serviceable.

The following details of cost of cultivation of Swede Turnips *per acre* in two localities of Herefordshire are given, by permission, for convenience of reference to non-agriculturists, with regard to some of the points to be considered in forming estimates. It will be observed that half the cost of the manure, carting and spreading (calculated per account rendered), has been deducted; as in the case of *Turnips* this serves for the following crop also:—

Particulars and cost of cultivating Swede Turnips per acre, 1881.

Three Farms at Pencombe.	£	s.	d.
Ploughing twice	1	4	0
Harrowing twice; crushing; scuffling, rolling, and ploughing (third time)...	1	0	6
Bouting out twice; carting and spreading manure; sowing artificial, and drilling seed	1	2	3
4 lbs. Swede seed at 10*d.*	0	3	4
4 cwt. artificial manure at 8*s.* per cwt. ...	1	12	0
12 cart-loads manure at 5*s.* per load ...	3	0	0
Second time scuffling, harrowing, bouting, drilling	0	11	3
4 lbs. Swede seed at 10*d.*	0	3	4
Scuffling hoeing, thinning, gathering, hauling	1	2	0
	9	18	8
Deduct half cost of manure, carting, &c., as above	2	11	6
Total ...	7	7	2
Estimated produce 15 tons, at 10*s.* per acre, consuming price	7	10	0

The following particulars are from a farm on which, for the past six or seven years, the contributor has regularly sown Mustard seed with the Swede seed, and has never failed to get a good crop of plants, and has had no occasion to sow a second time:—

BODENHAM (England's Gate).	£	s.	d.
Ploughing twice	1	6	0
Scuffling; rolling; bouting and drilling ...	0	16	0
Loading, carting, and spreading dung, and sowing artificial manure	0	11	3
5¾ cwts. artificial manure, as per bill ...	2	6	6
7 loads manure, at 5*s.* per load	1	15	0
Scuffling Turnips three times; hoeing, thinning, topping, and butting; loading and hauling	1	6	0
3 lbs. Swede seed at 1*s.* 4*d.* per lb.	0	4	0
1 lb. Mustard seed	0	0	6
	8	5	3
Deduct half cost of manure, carting, spreading	2	6	4
Total cost ...	5	8	9
Good crop, estimated 15 to 20 tons (say 15) at 10*s.* per acre, consuming price	7	10	0

On other farms in the same locality near Leominster, of which details of cultivation have been returned, the cost of the second sowing has been respectively 15*s.* and 15*s.* 6*d.* per acre.

It will be noticed that consuming price is set at 10*s.*; selling price is estimated at 15*s.* to 20*s.* per ton for the Swede Turnips.

HEREFORDSHIRE.

Swede and Turnip Crops of 1881. Damage done by Fly in Leominster District.

No.	Proportion damaged.		Proportion resown.		Remedies suggested, and Remarks.
	Partially.	Entirely.	Amount.	No. of times.	
1	... 4 acres ...	... 6 acres ...	... 6 acres ...	... Once ...	Have not found any remedies to do much good.
2	...One-half...	One-sixth	One-sixth	... Once ...	Some believed to be saved by fixing Elder-boughs to the Turnip scufflers, and so brushing the young plants when the dew was on.
3	...One-fifth ...	...One-fifth .. once. Two-fifths twice.	Three-fifths One-fifth	... Once ... Partially	In other years moistening the seed with crystal oil, and drying it again by mixing sulphur, has succeeded. One-fifth escaped, but no reason can be assigned except the above application, combined with light rolling. Common Turnips were not attacked by fly at all. The seed was dressed as above.
4	—	Three-fourths	Three-fourths	... Once ...	—
5	Three parts .	A quarter	A quarter	Three times	For remedy working the ground down early in the spring to keep it damp is suggested. Only reason apparent for crops having escaped is their being planted late.
6	... 5 acres ...	... 15 acres ...	... 15 acres ...	... Once ...	—
7	... 11 acres...	... 4 acres ...	... 4 acres ...	... Once ...	—
8	—	... 20 acres ... (the whole).	...20 acres ... A part	... Once ... Twice	Crops pretty good at last, but without suitable weather would have had nothing.
9	... About ... 2 acres.	—	... None ...	—	Sometimes a little soot or lime sown on them in the dew will help to keep the fly off. Reason of escape of crop may be very late planting. In general the fly is most prevalent early in the season.
10	—	..... All	..... All	... Twice ...	On heavy clay work ground before, and thus break it early (say March); work it up for roots nine days prior to planting, and cheat the fly, who will go away "with tears in their eyes."
11	...80 acres ...	... 17 acres...	... 17 acres...	... Once ...	Rolling when the dew is on checks the fly to some extent.
12	... Whole ...	About half .	About half .	... Once ...	No sure remedy; a fine seed-bed, forcing manures, and thick seeding will generally push the plant past the fly; also frequent rolling as soon as the crop appears above ground does good.
13	—	... 8 acres ...	... 8 acres ...	... Once ...	—
14	... About ... 2 acres.	—	... About 2 ... acres.	... Once ...	Has about twenty acres of Turnips, all very good. Land was well cultivated and manured early, and, after being ploughed twice, made very fine and let remain rolled down for about nine days before planting. This treatment, and not planting too early, considered a great preventive against the fly.

					[illegible] acre, and liberal application of artificial manure. The first week in June the best time for planting.
16	... About ... a quarter.	.. A quarter ..	One-eighth One-eighth	... Twice ... Thrice	Found this year that, by giving a slight dressing of slack-lime as soon as the plant is seen in the drill, the fly would not touch it. Soot answers the same purpose, but lime preferred. Seven acres of Turnips escaped; weather was favourable, and plants grew too fast for the fly to hurt them.
17	——	Three-quarters of Swedes (half-crop).	Half of root-crop.	... Once ...	A light dressing of equal portions of lime and soot when just showing out of ground.
18	——	..... All	..... All ..... About a q'rter	... Once ... Twice	Have tried several things, but to no purpose.
19	..... All	One-half in this neighbourhood.	...One-half ... Some of the farms	... Once ... Twice	Unacquainted with any remedy.
20	...Very few...	... None ...	Only about a quarter of an acre.	... Once ...	Steeped the seeds in paraffin, as I have done for some three years, and think the plant comes stronger; and the fly injures considerably less. Crop was very good.
21	——	... 2 acres ...	... 2 acres ...	... Once ...	——
22	... 7 acres ...	——	..... All ..... 3 acres	... Once ... Twice	Not able to suggest any unless planting early, say first two weeks in May.
23	... Not ... estimated.	... Not ... estimated.	... Some ... Some	... Once ... Twice	Liberal application of dissolved bones to commence, and frequent horse-hoeing.
24	——	6 acres of Swedes.	... 6 acres ...	— Once ...	Common Turnips were not attacked by fly, being planted later, and more favourable weather having set in.
25	——	The whole of the Swedes.	The whole	... Once ...	28 lbs. of carbolic powder was used, together with the same quantity of flour of sulphur, and a bushel of soot (drilled with the largest cups of the Turnip drill), which kept the flies away till the rain washed it off, and then they attacked the plants and destroyed them. The second crop was planted the second week in June, which is a good crop.
26	Early sown .	——	——	——	Considered that Swedes are sown too early in that locality.
27	... Three- ... quarters.	An eighth	About three-quarters.	... Once ...	Sprinkling with lime early when the dew is on the plant.
28	... 20 acres...	... 8 acres ...	... 8 acres ...	... Once ...	Ten acres escaped fly-attack.
29	... 15 acres ...	... 2 acres ...	... 5 acres ... 2 acres	... Once ... Twice	No remedy known, unless it be giving plenty of seed.
30	All more or less.	——	About12acres	... Once ...	Sow lime and ashes, mixed in equal proportions, on the young plant early in the morning when the dew is on. This is believed to have saved four acres, a quarter of the sixteen sown.

HEREFORDSHIRE.

(Continued).

Swede and Turnip Crops of 1881. Damage done by Fly in Leominster District.

No.	Proportion damaged.		Proportion resown.		Remedies suggested, and Remarks.
	Partially	Entirely	Amount	No. of times.	
31	Half	Half	4 acres	Once	———
32	——	The whole	The whole	Once	Only remedy known is rain, when fly is eating the crop.
33	1½ acres	4½ acres	4½ acres	Once	Believed that burnt soil will partially prevent the fly. The two acres that escaped out of eight had burnt soil under them.
34	——	11 acres	11 acres	Once	———
35	——	10 drills about 10 chains long.	10 drills	Twice	By sowing late (say end of June) and putting plenty of manure and a little Mustard seed, which comes up quickly, the fly gorges to its heart's content whilst the Swede is in its infancy. In ordinary seasons prefer sowing Swedes from 14th to 21st of June.
36	8 acres	2½ acres	2½ acres	Once	No remedy known.
37	——	12 acres	12 acres	Once	Four acres were planted with about 2 lbs. of seed extra to the acre, and they escaped the fly.
38	——	8 acres	8 acres	Twice	One thing is, they ought to be pnt in after rain, and not in the dry; next, to put plenty of seed, and the ground to be fine and firm, Many are afraid of putting too much seed, but a thick plant always grows faster than when it is thin.

Note.—*The returns from Leominster District are from parishes lying in a radius of seven miles from Leominster.*

HEREFORDSHIRE.

(*Continued*).

Swede and Turnip Crops of 1881. Damage by Turnip Fly in Districts specified.

EARDISLEY.—Principally gravel.

Amount damaged and resown—First sowing of Swedes wholly damaged throughout this district, and a large area of the second sowing. The succeeding crop was pretty good and regular, but not of the usual weight per acre, from being late.

Remedies suggested, and Remarks.—Do not consider there is any remedy, by reason of the effect of seasons and of atmospheric influences; when the seasons will allow the land to be thoroughly prepared for the seed, and a rapid vegetation and growth follows, the fly is powerless.

With regard to the reason why some crops have escaped, should say that no sufficient reason can be given further than the good fortune to get the seed in when the tilth and weather suit, as experience proves that a difference of forty-eight hours will affect it. Consider early sowing more liable to injury than late.

TARRINGTON.—Strong loam; some clay marl.

Amount damaged and resown.—All the early-sown Swedes were damaged, and nearly all had to be resown. The Turnips being later, did not suffer very much.

Remedies suggested, and Remarks. — No remedy known. The best method of dealing with the fly is to have the land fine, sow very thick, and stimulate the growth of the Turnip as much as possible by manures, &c. Where the land is clean, think it a good plan to work it fine, and allow it to lie rolled down in dry weather for a week or two, then plough and drill every day, if practicable; when the land is moist and fresh turned-up, simply stimulate the early growth as much as possible. No reason known for escape of special crops beyond a favourable state of the land, and of the weather, which varies from day to day.

PENNOXSTONE, ROSS.

Gravel, and sandy loam on red sandstone.

Amount damaged and resown.—This district suffered much from fly; many crops had to be resown two or three times.

Remedies suggested, and Remarks.—Have tried many experiments, some with a little, but none with complete, success.

MARLOW, LEINTWARDINE.—Loam on limestone; part light.

Amount damaged, and resown.—Estimated that three-quarters of the Turnip acreage of the neighbourhood has been damaged by the fly, and about one-half resown: in many instances resown twice.

Remedies suggested, and Remarks.—The only remedy known is to get the land well ploughed in the autumn, and keep the moisture in by scuffling only, in the spring, and making it as fine as possible before sowing. There should be an ample seeding and manuring, and, just as the seed is coming up, spread on about forty bushels of *hot* lime to the acre. This treatment is noted with regard to light land.

Can give no reason for some crops escaping the fly, except the particular time of sowing and the situation. Have often noticed where a field has been sown at twice with only a day or two between, and all cultivated and manured alike, that one part may be very good and the other very bad; in some seasons little damage is done by the fly, where the work is well executed; but this year all appear to have suffered alike, which I never remember before.

PENCOMBE.—Clay and clay-loam.

Amount damaged and resown.—All the Swede crop damaged, and almost the whole of the Swede ground resown, some of it twice; some was resown the second time with White Turnips. The White Turnips do not seem to have suffered much damage.

Remedies suggested, aud Remarks.—Thick sowing is suggested as most likely to save the crop, Sowing Mustard or White Turnip seed with the Swedes (by the side of them) is also proposed. Sowing soot or dust early in the morning over the young plants, if constantly repeated, would no doubt check the damage.

Rolling with a light wooden roll when the leaves are moist (as practised in some parts of Norfolk) would have the same effect, if repeated when the leaves of the plant had become free from dust.

BROCKHAMPTON, near BROMYARD.—Clay on sandstone.

Amount damaged and resown.—Sowing took place three times in several cases; in some four times.

Remedies suggested, and Remarks.—I sow on the flat, if possible without ploughing the land in the spring, and roll down as firm as possible, as I find the Swedes come away much quicker out of the way of the flea if the land is really firm. With regard to reason of special crop escaping, part of a field was accidentally drilled with the Mangel-barrel, and of course was four times too thick; that part, though covered with fleas, recovered; the rest of the field sown with the Swede-barrel had to be resown. I think I saved many of mine by having a board on very low wheels drawn quickly up and down the field, and having a curtain suspended from it to the ground to make the fleas jump against the board, which was fresh painted at each turn; I certainly killed thousands, and my Turnips lived.

SUFFOLK.*

Damage by Turnip Fly and Grub in Weybread Parish, &c.

This table gives information contributed by twelve of the farmers in the parish of Weybread, Suffolk, and one in the adjoining parish of Fressingfield, for which I am indebted to the help of the Rev. H. J. White, Vicar of Weybread.

No remedies were tried in any case, nor was the seed in any case put in with the water-drill, nor the water-cart used.

Of these thirteen farms only two escaped fly-attack, on Swedes and Turnips, Nos. 1 and 6: in the case of the first the Turnips did not come up at the first sowing, and resowing was late; in the second the use of salt, at the rate of three hundredweight per acre, is noted, and also that it was light land. At No. 4, though attack was bad, it is also observed that the crop on light land was good.

At No. 2 there was bad attack on both Swedes and Turnips, and the Swedes were only half a crop; whilst the Turnips, similarly managed in all respects excepting that exactly *double the amount of seed* was sown, were a full plant, and the crop was good, though late.

Nos. 5 and 10 both suffered severely, although a good amount of seed was sown; but it will be observed that the state of tilth was not considered satisfactory by the contributors, who only note it as "fair."

At No. 11, where there is an entry of "sheep-folding only," and at No. 12, where "burnt earth only" is mentioned as having been applied to the Turnip, fly was bad, and there was "no crop" of Turnips; but the Swedes, with the help of farmyard and artificial manure, together or separately, did much better, giving half a crop in one case, although badly attacked, and escaping attack in the other.

At No. 18 the loss was total, but Mustard sown instead of Swedes, which were destroyed, gave a good crop.

* In the case of the Suffolk table the amount of information with which I was kindly favoured being furnished (as given) in tabulated form, I regret not being able to offer fuller details as to calculation of money loss; also in eleven of the twenty-six series of entries a difficulty arises with regard to the especial object of this paper from loss by "grub" being recorded together with that of the "fly." It will be observed, however, that of these eleven entries eight mention amount of crop, and one mentions no crop (also of Swedes) without any record being made of resowing; consequently the only considerations of resowing affected appear to be the entries of "Turnips sown twice" at Nos. 8 and 9. These observations refer also to a portion of the remarks, p. 50, lines one to three from the top.—Ed.

At Nos. 2, 3, and 5, the Turnips appear to have suffered less than the Swedes; whilst at Nos. 7, 8, 9, 10, 11, and 12, though both suffered and Swedes were very deficient, Turnips appear to have been a total failure, "no crop at all" being the terse and sad record on the sheet of original contribution from these six farms.

It is manifest the attack was general and severe over this district, and further details as to previous cultivation and points of treatment would have been very serviceable. Without these it would be unsafe to offer any opinion, but looking at the general view, some of the worst among the severe cases appear to have been where there was no application of manure, or farmyard manure only was given without superphosphate, which observations elsewhere show to be of much service in giving a good start to the first growth; also the amount of seed used appears less than what is considered desirable in other districts, at the estimate that a pint of Turnip seed weighs about 12 ozs., or ¾ lb.

SUFFOLK.

No.	Crop.	Amount of seed per acre.	State of Tilth.	Manures.	Attacked by Fly.	Attacked by Grub.	Amount of loss per acre.	Money loss.	Remarks.
1	Swedes Turnips	1½ lb. ,,	Fine	Bone superphosphate and farmyard ..	No..... ...	... ...	None	... ...	Turnips did not come up; resown. First sowing end of June.
2	Swedes Turnips	1½ pt.* 3 pts. ...	Fine	10 loads of farmyard, and 2 cwt. of bone superphosphate per acre.	Yes+... Yes.....	Yes..... ...	⅓ crop ..... No loss, but late ...	£3	Turnips not resown, and, although badly attacked by fly, a full plant.
3	Swedes Turnips	2 pts. ... ,, ...	Fine	Farmyard only	Yes..... Yes.....	Yes..... No.....	¼ crop..... ¾ crop.....	£5 ... £5 ...	Three sowings of Turnips.
4	Swedes Turnips	3 pts. ... ,, ...	Fine ...	Farmyard only	Yes..... Yes.....	Yes..... No.....	½ crop on heavy land Good on light land.	£5 ... £5 ...	Three sowings of Turnips.
5	Swedes Turnips	4 pts. ... 3 pts. ...	Fair	Farmyard, and Turnip artificial manure	Yes..... Yes.....	Yes..... ...	No crop ..... 1-10th loss by fly ...	... ? ...	Turnips estimated at ½ crop. 1-10th loss from fly; further loss effects of season
6	Swedes Turnips	2 pts. ... ,, ...	Fine	Farmyard. Salted Swedes and Turnips 3 cwt. per acres	No..... No.....	No..... No.....	No attack ..... ,, ...	... ? ...	Light land.
7	Swedes Turnips	3 to 4 pts. ,,	Fine	Farmyard..... Artificial Turnip manure	Yes..... Yes+...	Yes..... ...	¼ crop..... No crop	... ? ...	Two sowings of Turnips.
8	Swedes Turnips	2 pts. ... ,, ...	Fine	Farmyard and artificial..... Farmyard and salted	Yes..... Yes.....	Yes..... Yes.....	¾ crop..... No crop	... ? ...	Turnips partly sown twice.
9	Swedes Turnips	2 pts. ... ,, ...	Fine	Farmyard only	Yes—... Yes+...	Yes—... Yes+...	¼ crop..... No crop.....	... ? ...	Turnips sown twice.
10	Swedes Turnips	4 pts. ... ,, ...	Fair	Farmyard only	Yes+... Yes+...	Yes+... ...	¾ crop..... No crop	... ? ...	
11	Swedes Turnips	4 pts. ... ,, ...	Fine	12 lbs. farmyard, 4 cwt. artificial ... Sheep-folding only	Yes+... Yes.....	Yes..... ...	½ crop..... No crop	... ? ...	Turnips sown three times.
12	Swedes Turnips	3 pts. ... ,, ...	Fair	Farmyard and artificial separately ... Burnt earth only.....	No..... Yes+...	No..... ...	No crop	... ? ...	Turnips sown twice.
13	Swedes Turnips	3 pts. ... 2 pts. ...	Fine	Farmyard, 14 loads per acre	... ...	... ...	Loss total	? ...	Mustard sown in lieu of Swedes, and fine crop resulted.

FLY-ATTACK ON ROOT CROPS AT BROOM CLOSE, BOROUGHBRIDGE, YORKSHIRE, IN 1881.

WHITE TURNIPS.

Sowing.		Manure.	Weather at time.	Germination.	Fly Attack.	Quality and Rent of Land.	Remarks.
Date.	No. of Acres.						
Plot 1 May 21	4	5 cwt. of dissolved bones per acre. No fold - yard manure	Dry	Came up quickly	Fly commenced attack at once	Light sand on red sandst'ne Turnip and Barley soil	About three-quarters of the necessary plant left by the fly. This Plot and Plot 2 were dressed exactly the same, the ridging-plough going immediately before the drill which sows manure in the ridge immediately below the seed.
Plot 2 May 28	4	Same as above	Heat and droughty	Came up at once	Never touched by fly, excepting a dozen or so of ridges adjoining Plot 1	Same soil as above. Rent of Plot 1 & 2 50s. per acre	Plot 2 fit for the hoe quite a week earlier than Plot 1.
Plot 3 June 21	10	Rotten fold-yard manure	Showery	.....	Not attacked by fly	Strong clay, not adapted for roots. Rent 30s. per acre	Land in anything but good condition for Turnips, as it worked very rough. Plants fit for the hoe by the 11th July. An excellent crop.

SWEDES.

Plot 4 May 19	8	One half the field green manure from yards, the remainder rotten from heap, and 5 cwt. of dissolved bones per acre	Very warm & dry until 24 May, when we had rain	Came up badly	Fly ate them all	Strong-bodied soil twice ploughed & ridged	Considered that this field being eaten off may be explained by the ridges having got dried through, so that the plants did not start simultaneously.
Same Plot June 11	Re-drilled	.....	.....	Came up irregularly	Partly eaten off	.....	These never throve from the beginning; were not fit for the hoe until the 19th of July, and are a very poor crop.
Plot 5 May 25 & 26	11 drilled on the flat	One half of this field rotten manure from heap, & the remainder green manure from yards. All, 5 cwt. of dissolved bones additional	Showery on night of 24th	.....	Fly took the whole of the plant	Land was in capital condition for reception of seed, and a good strong loam on clay	This field had been steam-cultivated, and dragged during winter as opportunity offered. The manure applied at once and ploughed in (the only time the land was ploughed).
Same Plot June 23, 24 & 27.	Re-drilled	.....	.....	Came away at once	No fly on 2nd crop	.....	One more ploughing.
Plot 6 (part of same field) May 28	5	.....	Very heavy thunder-rains on night of 26th, which prevented getting on the land before	Came well	Never touched by fly	.....	An excellent crop. These two Plots (5 and 6 in one field) were treated exactly the same way.
Plot 7 June 4 & 6	12	Green manure from yards applied in the ridges, and 5 cwt. of dissolved bones	Rain fell on 6th directly the field was finished, then two cold days followed by growing wea-	.....	No fly ever on this	Light land on gravel, well adapted for roots. Rent 50s. per acre	Drilled in ridges after Oat-stubble, land ploughed, and ridged. Plants grew rapidly, and were hoed by July 11th. We had a great crop of Swedes, considering the season.

YORKSHIRE.

Summary of Table.

This table gives particulars, contributed by Mr. W. Scott, from Broom Close, Boroughbridge, Yorkshire, regarding attack of Turnip Fly, including dates of sowing and germination, and is of great value, showing the effect of well-moistened soil in pushing on the plant so as to drive it past the power of the fly.*

It will be observed that the first sowings of plot 4 on May 19th, plot 1 on May 21st, and one sowing of plot 5 on May 25th and 26th were attacked, and plots 4 and 5 entirely eaten off: the weather at sowing-time being noted at the various dates as being warm and dry; dry; and showery on the night of the 24th.

From the rainfall returns it appears that the total amount of rainfall during April (at Aldborough, Boro-Bridge) was only 0·74 in.—that is, somewhat less than three-quarters of an inch; and from the 1st until the 19th of May the fall only amounted to 0·82. This small amount of rainfall would be rapidly absorbed or evaporated, and the consequence would be a dry ground much more suitable for fly presence, as observed, than growth of the young Turnips.

Plots 2 and 6, both drilled on May 28th, after *such a heavy thunder-rain on the night of the 26th as prevented getting on the ground sooner* to continue work, were never touched by fly, excepting a dozen or so of ridges in plot 2, next the infested plot 1; and this absence of fly is especially important to observe in the case of plot 6, as this is part of the same field as plot 5, of which we thus see that the part sown before the thunder-rain of the 26th was taken *entirely by fly*, and the part of which the sowing was delayed two days by this rain was never touched, and gave an excellent crop. This rainfall amounted to 0·54 in.,—that is, rather more than half an inch, representing a fall of rather more than fifty tons per acre,—and must have completely soddened the surface, consequently set up a supply of moisture for a few days, which would do good, both at the roots and by evaporating round the young plants, which it will be noted respectively "came up at once" and "came well," and thus were carried on till the rainfall seven days later, from the 4th to the 8th of June, occurred to help vegetation, followed by successive rains from the 15th.

Plot 7 sown on June 4th and 6th, plot 8 sown on June 21st, and plot 5 redrilled June 23rd, 24th and 27th, were sown when rainfall was recommencing on the moistened land, or was well established,

* For the returns of rainfall at Aldborough, Boroughbridge, that are appended I am indebted to the courtesy of the Rev. R. W. Marriott.

and on these plots there was *no fly-attack*, although in the case of plot 8, sown on June 21st (when it will be seen there had been *good rainfall* for some time), the ground was in anything but good condition for roots on account of its working rough.

The second sowing of plot 4, which was re-drilled on June 11th, came into the period at which others throve, and was "partly eaten"; but, looking at the bad amount of fly previously present on the ground, this partial destruction seems likely enough; and also, in this case, sowing and re-sowing took place, respectively, on May 19th and June 11th, so that there was not as good an interval between as in the satisfactory re-sowing of plot 5. In this case the first sowing, which was destroyed, took place on May 25th and 26th, and the second, which was not attacked on June 23rd, 24th, and 27th, thus being put in after a longer space of time, including in it rainfalls of more than a quarter of an inch on several days.

Rainfall at Aldborough, Boroughbridge, Yorks, 1881.				
Date.	April.	May.	June.	
		ins.	ins.	
1	Total Rainfall of April, 0·74 in.	Amount registered from 1st to 13th is total Rainfall during this period.	—	Contributed by the Rev. R. W. Marriott.
2			—	
3			—	
4			0·20	
5			0·01	
6			0·42	
7			0·07	
8			0·01	
9			—	
10			—	
11			—	
12			—	
13		0·26	—	
14		0·19	—	
15		0·11	0·01	
16		0·03	0·27	
17		0·12	0·26	
18		0·01	0·20	
19		0·10	—	
20		—	0·22	
21		—	0·28	
22		—	0·46	
23		—	—	
24		0·18	0·17	
25		—	0·05	
26		0·54	—	
27		—	—	
28		—	—	
29		—	0·10	
30		—	—	
31		—	—	
Total	0·74	1·54	2·73	

Note.—Page 66, line 14, "an implement called a K."—The name is "Koldmoos Weed Eradicator"; it is described as a horizontal drum revolving at high speed between two carrying wheels; the drum being furnished with rows of combs protruded and withdrawn by machinery, whereby the weeds entangled amongst the teeth are either pulled up or the flowering heads torn away.—Ed.

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6th REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

DURING THE YEAR 1882,

WITH METHODS OF

PREVENTION AND REMEDY,

AND

SPECIAL REPORT ON WIREWORM.

BY

ELEANOR A. ORMEROD, F.M.S., &c.,

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PREFACE.

THE season of 1882 was, on the whole, remarkably free from wide-spread attacks of insects occurring to any greatly injurious extent, with the exception of those of Aphides, which were the cause of serious loss, amounting to little less than devastation of the Hop crops.

Reports from many localities, including England, Scotland, and the South-west of Ireland, mention that very little harm was caused by attack, as, in consequence of the weather being generally suitable for plant-growth, the crops held their way under moderate injury; and also the amount of rainfall, or of showers, was unfavourable to the increase of some kinds of insects, and checked the activity by which, in sunshine and drought, many of them spread themselves far and wide. For this reason, although Turnip Fly, the great cause of loss in 1881, made its appearance, the increase did not again become a general disaster.

The chief attacks were those of Apple Weevil on the Apple blossom in the spring, and some bad cases of local injury from Daddy-longlegs grubs; later on the caterpillar of the Winter Moth did much harm to leafage; and the circumstance occurred (very rarely observed in this country) of attack by Cockchafer grubs taking place, to a seriously hurtful extent, on the roots of young Pines in plantations extending over a large extent of country.

Wireworm did much harm in a few localities, but not as a general pest; and there were also local attacks of Clover, Pea and Turnip Weevils, causing much loss to the respective crops; the brunt of the year's attack, however, fell on the Hops. This loss is estimated by Mr. C. Whitehead, of Barming House, near Maidstone, as not less to the Hop planters of the United

Kingdom than £1,750,000 (that is one and three-quarter million pounds sterling) from this year's blight; with the addition of the loss to labourers of at least £200,000.

Many notes are given of loss by Wireworm, but just taking a few of these one gives a loss at the rate of 2 quarters per acre over a 17 acre field of Barley, this amounting at the then market-price to £3 per acre, or a total of £51; another gives a deficiency on 15 acres of Wheat, estimated at £8 8*s*. per acre, consequently £126 on the field; and an estimate of the money loss in an average of seasons on 350 acres of a 1000 acre farm, in Hampshire, is given as £2 per acre, that is £700 loss yearly.

Loss by Weevil attack to Peas is estimated in one case as not less than £20 on 6 acres; in another case as not less than £50 on 9 acres, besides further loss on deficiency of straw, &c., estimated at £20 more; and there is also an estimate of loss by weevil on 2 acres of Vetches amounting to £20.

Many other notes of loss are given, and each year's Reports show more and more the heavy losses that occur; but they show at the same time that in many cases they may be much lessened by measures falling within the common course of husbandry.

Cleaning the ground well beforehand, and destroying weeds and rubbish which shelter the insect vermin (and which in any case are better away), act at once towards lessening the numbers of some of our worst pests; and the good husbandry which grows a hearty crop very much lessens the effect of attack in any case. This matter may seem so plain as not to be worth mentioning, but the practice long held its ground, and often does so still, of neglecting all care until the enemy is in possession, and then too often it happens that to the loss of the crop there is to be added also the outlay for applications that did no good. We need to know the method of life of the crop-pest to be able to apply special care serviceably, and it will be seen that some information long needed has been worked out in the past season.

The discoveries of the place of feeding of the Pea and Clover Weevils (*Sitones*) are very important, and new observations have also been made as to Cabbage-root and Onion Flies, Wheat-bulb Fly, Ash-bark Beetle, Pine-bud Moth, and a small Midge-gnat that forms galls in the cone of the Spruce Fir.

It will be noticed (especially in the Wireworm report) that although, as we all know, Rooks are of great service in clearing ground of grubs and Wireworm, that there are drawbacks to

their services in the fact of the bird's researches sometimes destroying as many plants as the grubs do which they are looking for; and I would submit that it is a matter for serious consideration, whether the great encouragement of bird-life *beyond the natural balance*, such as is now often recommended, may not lead to very contrary results to what is intended. Besides the damage that *over-numbers* of birds may cause to the young crops or ripe corn, it ought also to be borne in mind that many insects (such as carnivorous Beetles and their grubs, and the grubs of Ichneumon Flies) live wholly or in part by feeding on their fellow-insects; and it is desirable to consider how an unnatural overplus of birds bears on the matter of diminishing these helpers. Without in any way doubting the necessity of the presence of a proper amount of birds, I think it would be well worth while, by examination of the contents of the stomachs of some of the smaller birds, to gain clearer views of what is the chief part of their insect-diet.

Any notes that I may be favoured with during the coming season, on any point bearing on prevention of injury, will be most thankfully received; and I will venture to suggest that, amongst the communications I am favoured with, none are so valuable as those noted at once whilst the attack is present, or which are then made the subject of correspondence, as many valuable details are thus gained which otherwise might be overlooked.

I shall be most happy to endeavour to offer any information in my power (or which I can obtain) to those who may desire it, and more especially I shall be glad to receive any communication regarding Hop blight.

It now remains for me to offer my hearty thanks to all who have enabled me by their information to compile my present Report; and I have also to thank Prof. J. O. Westwood, Mr. R. H. Meade and Mr. W. L. Distant for kind assistance in determining specimens with which I was not fully acquainted.

A few illustrations, not previously given, have been added, some drawn by myself; and a few of the figures, originally allowed me by the courtesy of the Editor of the 'Gardener's Chronicle,' are again inserted; but the larger number are by permission of Messrs. Blackie & Son, Glasgow, to whom I offer my thanks for the prompt courtesy with which they accord their assistance.

It is with great satisfaction that I can allude to the increase of attention to the subject of prevention of insect ravage during the past season, both at home and in our colonies; and whilst I hope my contributors will be so far satisfied with the Report of heir observations as to entrust me again wi .h their notes for a similar purpose, I can earnestly promise that on my part I will gladly give the most careful attention in my power to all communications they may favour me with.

ELEANOR A. ORMEROD.

DUNSTER LODGE, NEAR ISLEWORTH,
March 19*th*, 1883.

NOTES OF OBSERVATIONS

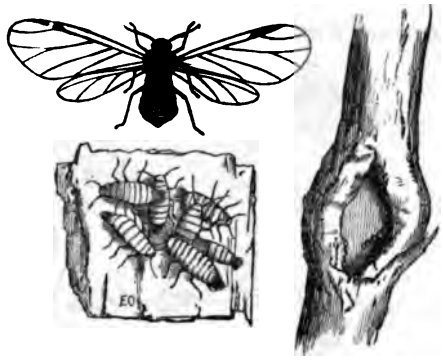
OF

INJURIOUS INSECTS

DURING 1882.

APPLE.

American Blight; Woolly Aphis. *Schizoneura lanigera*, Hausm.



SCHIZONEURA LANIGERA.

Winged Woolly Aphis, magnified; larvæ, much magnified.
Apple twig, with the same larvæ, natural size, at the lower part of the infested spot.

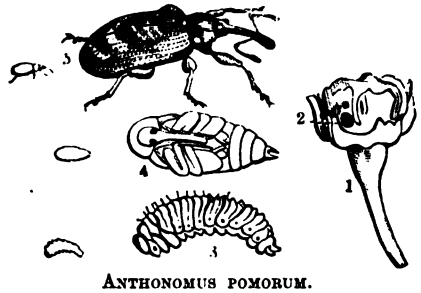
MR. MALCOLM DUNN, writing on the 10th of July from The Gardens, Dalkeith Palace, N.B., mentions, "We are generally not much troubled with American blight in this district, but this year it has broken out rather severely on a few of our Apple trees, and I have destroyed it by washing them with strong soap-suds, in which I put about half a wine-glass of paraffin to a gallon of the suds, and apply with a syringe or the garden-engine."

"I find soft-soap an excellent insecticide, wherever it can be applied with safety to the plant: made into a thick lather, and applied with a stiff brush to the stems of Apple trees infested with 'American Blight,' it is a certain remedy. In the winter, when the trees are at

rest, it may be applied all over the tree; and if the roots are uncovered from the base of the stem onwards, as far as it is easy to get at them, and the soft-soap is applied to them also, the treatment will go far to stamp out the pest. Even a thorough soaking of the soil in which the roots run, with strong soap-suds, repeated a few times during winter, is a first-rate means of keeping down American Blight; of course the soft-soap must not be applied (as above) to green leaves or bark: it is so caustic that it invariably burns them, especially if the sun strikes on the soap; therefore it must be used with caution in summer."

Mr. F. Macey, writing from the gardens at Longmoor, near Forest Gate, mentions that the only attack of injurious insects occurring to any extent was on the Apple trees, which somewhat suffered from American Blight. He remarks, "As mine are pyramidal trees of small size I am able to wash them with a solution of paraffin and water, about one-third of the former to two-thirds water, which I find a certain cure."

Apple-blossom Weevil. *Anthonomus pomorum*, Curtis.



ANTHONOMUS POMORUM.

1 and 2, Apple-bud pierced by weevil; 3, maggot; 4, pupa; 5, weevil: all mag. with lines, showing nat. size.

On the 2nd of May I received specimens of the maggots and chrysalids of the Apple-blossom Weevil from Mr. Edward Frere, of Lucombe, Isle of Wight, with a note of great injury being caused yearly by its attack to the buds of his Apple and Pear trees, just as they were coming into blossom. He observes, "I used to have a great abundance of fruit, both Apple and Pear; I now scarcely get any, owing entirely to the ravages of this horrid insect."

Mr. T. H. Hart also forwarded specimens of the Weevil in its early stage from near Kingsnorth, Kent, and mentioned that larvæ of these Apple-blossom Weevils had terribly ravaged the Apple blossom, and that scarcely a bunch of flowers was to be found without its destroying tenant. Pinching the discoloured buds, before the

maggot had time to change to the beetle state and escape, was found serviceable, in the case of espaliers in gardens, in clearing off attack for future benefit.

In the orchards round Isleworth and Hounslow there was also much mischief done to the Apple buds by this maggot.

The method of attack is for the female beetle to lay her eggs singly in the unopened blossom-buds of Apples, and sometimes of Pears, and here the maggot soon hatches, and feeds within them, thus soon killing the infested buds, which may be known by the petals or flower-leaves soon withering into a brown cap, instead of expanding. Under this shelter the maggot quickly goes through its changes, first to a chrysalis, then to a small long-snouted weevil of various shades of brown or greyish tint, with sloping bands on the wing-cases. In the following winter the weevils shelter under rough bark, clods of earth, or in any convenient nooks on or near the trees; and with the return of spring they come out again. The common measures of keeping bark in good order, clearing away rubbish, and attending to the condition of the stakes of espaliers and the proper pointing of walls, will all help to keep this pest in check in gardens. The males fly round the branches, but the females are stated rarely to fly, and the weevils fall when they are alarmed; therefore shaking or smartly jarring the branches of infested trees, and throwing a ring of fresh gas-lime, or placing a band of anything convenient soaked with tar round the stem of the tree, or using any other means by which the beetles may be prevented creeping back up the tree to the branches, will be very serviceable.

Winter Moth. *Cheimatobia brumata*, Stephens.

CHEIMATOBIA BRUMATA.

Winter Moth. Male, winged; female, with abortive wings.

The caterpillars of the Winter Moth have been injurious in various localities during the past season. On June 9th they were mentioned as occurring in such great numbers at Bridley Manor, Guildford, as to be ruining the Apples in the nurseries.

Mr. Edward Parfitt, writing from Exeter, mentions them as having been very numerous; and the exceedingly severe attack on the Oaks

at Longleat, near Warminster, appeared, from the specimens forwarded to me on June 19th by Mr. Taylor, to be almost, if not entirely, caused by these caterpillars.

No notes of means of prevention have been sent in, but something might be done to check (at least in garden cultivation) the ravages of this destructive caterpillar, which feeds on the Apple, Pear, and Plum, besides the Oak, Elm, Lime, and many other trees.

The Moths, which come out from chrysalids lying in the earth, appear about the beginning of November; and during November and December the females, not being able to fly, creep up the trees to lay their eggs on various parts of the twigs, or in crannies of the bark. If anything, therefore, is put round the trunk of the tree, which the Moths will stick fast in or will not attempt to cross, its safety from attack (in all cases where it stands apart from others and from supports) is fairly well secured.

Where fruit trees are pruned after December it is desirable that all the small twigs that fall to the ground should be carefully removed, that any caterpillars hatching from eggs on these twigs may not be able to get to the trees.

The caterpillars hatch in spring, and feed first on the young unopened buds or young leafage, and, where they are numerous, clear off every morsel that is eatable on the boughs, webbing some of the remains of the leaves together as they proceed for a shelter. The caterpillars are about half an inch long, and form a loop when walking, very similarly to those of the Magpie Moth (see figure), and the colour is greenish, with a black or blue line along the back, and whitish lines along the sides.

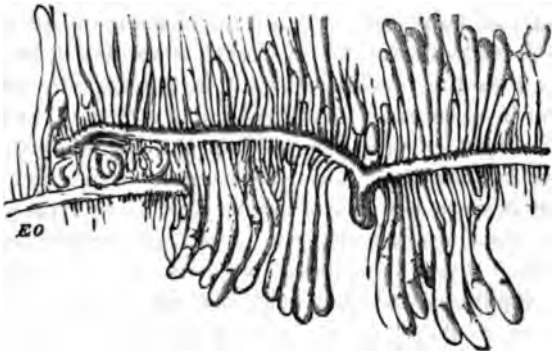
ASH.

Ash-bark Beetle. *Hylesinus Fraxini*, Fab.

The following notes of the habits of the Ash-bark Beetle, *Hylesinus Fraxini*, are from observations taken by Mr. Angus M'Intosh, Llanerch, Llanelly, S. Wales, and amongst other information give the locality of the winter quarters of the beetle.

On March 16th I received specimens of rough, thick, Ash bark, just taken from living trees, bored into by Ash-bark Beetles, which were then still in their winter holes. These bores or tunnels resembled small shot-holes, and ran indifferently up, down, or to either side, but were all single,—that is to say, they were never branched like the

breeding galleries (see fig.); they were seldom more than three times as long as the beetle, and at the end of these tunnels the beetles appear to pass the winter. About the middle of February beetles had been found in them, some alive, though not active, and some dead; and the specimens of bark sent me on March 16th similarly contained Ash-bark Beetles in the borings, some alive, some dead.



HYLESINUS FRAXINI.

Workings of Ash-bark Beetle.

Hybernation appears to begin towards the end of September, as on the 22nd of that month beetles were found making their way into healthy bark; and specimens were forwarded in which the beetles, then developing, instead of having escaped as usual by a hole through the bark at the end of the bores they had eaten out while maggots, were to be found turned in the other direction (in short borings, like the winter ones) into the solid wood.

The beetles infest trees of all sizes for these winter tunnellings, and do much damage in the locality, as they work into healthy, as well as sickly, trees for this purpose; and though they for the most part bore into the bark round the base of dead branches or twigs, or into the young bark forming over the wounds caused by pruning, they do not confine their attacks to these places. They also often work their way into the bark by the side of dead leafless Ivy.

On May 5th more specimens were forwarded to me, taken out of the tunnels where they had wintered in an Ash tree of about fifty years of age; at this date the beetles were beginning to quit their winter quarters, possibly rather later than usual on account of the cold weather in April.

Passing now from the winter borings to the breeding galleries, by May 24th the beetles were well at work at these; some had got the length of half an inch or more with their tunnels, and were now accompanied by their helpmates, and in some cases the pair were at

work in forming the forked part of the gallery, one going to the right and the other to the left,* from the short gallery whereby they entered. The specimens sent were taken from *felled Ash timber*, of which the bark varied from one-eighth to one-fourth inch in thickness, the holes by which the beetles entered, and which appear on the outside like small drillings, being most numerous on the part where the bark was thickest. Measurements were carefully taken as to the thickness of the bark used for breeding galleries, and of these none were found in bark of less than one-eighth of an inch in thickness.

On June 15th the beetles were still laying eggs in some of the galleries, but in some cases these were full of grubs. The beetle was not found boring for *laying purposes* into the growing tree (with the exception of two or three holes, which were begun and deserted), conjecturally because the flow of sap at this time of the year would be injurious to the egg and the grub. Before a tree becomes suitable for a breeding place, it appears requisite that it should be so unhealthy, wholly or in part, that the sap should have almost entirely ceased to flow. At the time of boring the winter tunnels there is little or no flow of sap. (Also the beetle is then in its perfect stage, not in its feeding larval condition.—Ed.)

From observations taken it does not appear that attack would be likely to occur to healthy trees unless there were *felled or unhealthy trees* near that were suitable for *breeding places*. From these they pass to other trees, healthy or unhealthy, and by means of the short winter tunnels which they bore into these trees the Ash-bark Beetle is injurious. Soils which from defective drainage, or which from their nature (as cold, stiffish clays), are *un*suitable for the Ash, by producing *un*healthy trees produce also breeding places for the beetle. Also the custom, where there are large rough hedges, of laying the Ash, is objectionable, and Ash thus operated on is to be found in some districts much infested by the beetle.

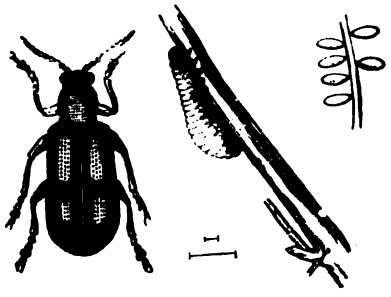
With regard to remedies, the removal of such felled timber, and dead or dying branches as are suitable for the breeding galleries, is

* To complete the history, I may mention from my previous observations that the tunnels noted as carried on to the right and left are continued by the two parent beetles until they are about an inch and a half long (see fig.). The female then lays her eggs near together in a line along each side of the two borings; from these the whitish, legless grubs soon hatch, and each eats for itself a tunnel in the soft inner bark, as nearly at right angles with the mother's gallery as circumstances will permit; but as the grubs grow rapidly, and room is limited, the tunnels of many of the weaker ones and the lives of their tenants are cut short. The successful larvæ complete their borings in about three weeks, and turn to chrysalids at the extremity, from which most of the beetles emerge in about a fortnight more, or gradually for some weeks, eating their way out through the thin remains of the bark covering their chrysalis cells. The beetles are about the sixth of an inch long, dark brown mottled with ashy, and with clubbed horns.

suggested, and also that this should be in the month of June,—that is after the beetle has laid her eggs, and before the young brood from them have developed to the perfect stage. Also, where the standing trees which are attacked are young, it is advised that careful hands should go over them, and (during the month of March, and guided by the shot-like holes in the bark) pare off the outer bark down to the depth at which the beetles are hybernating in tunnels. This remedy would cause little injury to the trees, but is not advised earlier than March, as the Ash is liable to the injury of the bark rending through frost, known as frost-bite.

ASPARAGUS.

Asparagus Beetle. *Crioceris Asparagi*, Linn.



CRIOCERIS ASPARAGI.

Asparagus Beetle, larva, and eggs (all magnified); lines show natural length of eggs and beetle.

Specimens of the Asparagus Beetle, together with its eggs and grubs, were forwarded on the 14th of June by Mr. R. Cooke, from Detling, Maidstone, with observations of the damage caused by the grub eating off the outer rind of the Asparagus.

These beetles are about a quarter of an inch long, and of a blue-black or greenish colour, with ochrey coloured patches on the wing-cases. They lay dark-coloured spindle-shaped eggs on the shoots or unopened flower-buds of the Asparagus, these eggs being fastened by one end, sometimes in rows, but sometimes the egg may be found fixed by its end to another similarly fixed to a shoot. The grubs are of an olive or slaty colour, and do most mischief by feeding on the leaves and shoots during the fortnight's time that their period of feeding lasts. They then go down into the ground, where they change to chrysalids, from which the beetles come up in about two

or three weeks, and there is a succession of broods, so that the insect may be found in all its stages throughout the summer.

The grubs hold on to the stems so tightly by the ends of their tails that it is a hard matter to pick them off; but if the Asparagus is syringed with warm water (or cold may be used), and the plants then smartly shaken, many of the grubs will fall to the ground. A good sprinkling of soot or of quick-lime, thrown down on them immediately, will prevent them, or most of them, returning to the plants. Dipping the shoots in a mixture of a quarter of a pound of flour of sulphur, a quarter of a pound of soot, and half a pound of soft-soap, all well stirred together in a pail of water, has been found useful.

BEAN.

Bean Aphis; Black Dolphin; Collier. *Aphis rumicis*, Fab.

Bean Aphis. 1, Bean-shoot with Aphides; 2, male, magnified; 3, natural size; 4, wingless female, magnified.

The only note of the presence of Aphides, or Collier, occurring on Beans to a destructive extent during the summer, was forwarded by Mr. Harley Kough, of Church Stretton, who mentioned, on July 8th, that the Beans in his garden were greatly blighted. No better remedy appears to be known at present than cutting off as much of the top of the Bean plant as is infested directly the Colliers are seen upon it, taking care, at the same time, that the pieces which are cut off shall be removed and destroyed, so that the Colliers shall not be able to get back again from them to the growing Bean crop.

At Detling, Maidstone, it is noted by Mr. R. Cooke that attack of Bean Aphis was kept fairly in check by picking off and burning the tips of the shoots affected; and at Park Farm, near Kingsnorth, Kent, the field crops were generally clean.

BEET.

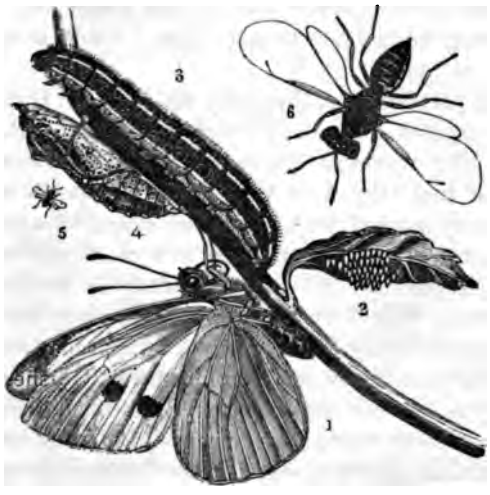
Beet, or Mangold Fly. *Anthomyia betæ*, Curtis.

BEET, OR MANGOLD FLY.
Beet Fly (female), magnified; line showing spread of wing, natural size. Head, mag. Pupa, nat. size and mag. Eggs (after Farsky), mag.

The only observation forwarded during the season of serious attack from the Beet Fly, was an outbreak on about seven acres at Portnard, Pallasgreen, Ireland, mentioned by Mr. R. E. Lloyd as occurring towards the latter part of June. No information has been contributed as to remedies for attack beyond those already named (see Report on Injurious Insects for 1880), which turn mainly on supporting the crop by stimulating dressings whilst it continues, and also (whilst the attacked plants are small) drawing and destroying them.

CABBAGE.

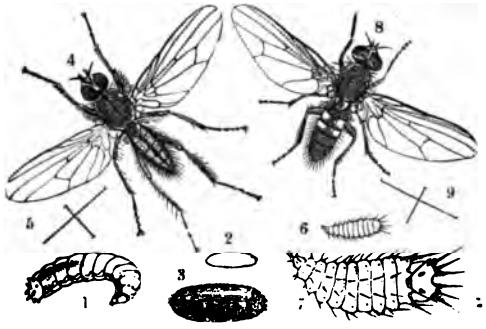
Large Cabbage White Butterfly. *Pieris Brassicæ*, Latr.



PIERIS BRASSICÆ.
1, Female Butterfly; 2, eggs; 3, caterpillar; 4, chrysalis; 5 and 6, parasite Ichneumon fly, *Pteromalus Brassicæ*, nat. size and mag.

During the autumn a good many caterpillars of the Large Cabbage Butterfly appeared on a bed of Broccoli in my garden near Isleworth, which I fonnd were most conveniently got rid of by hand-picking, otherwise these caterpillars are not mentioned as having been injurious during the past season.

Cabbage-root Fly. *Anthomyia floralis*, Fallen.



CABBAGE-ROOT FLY.

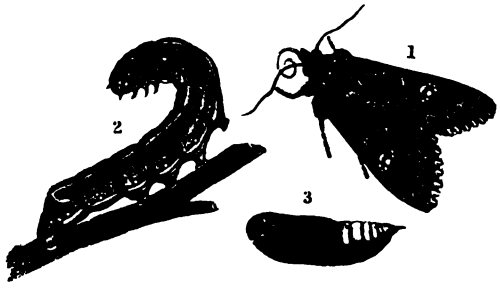
1, Larva of *Anthomyia Brassicæ;* 2 and 3, pupæ, nat. size and mag.; 4, *A. radicum*, mag.; 5, nat. size; 6-9, *A. tuberosa*, larva and fly, mag. and nat. size.

During 1881 much damage was done by Cabbage maggot in Scotland, and as several of the different kinds of maggots infesting Cabbage roots are so much alike that it is scarcely if at all possible to tell the difference between them, and the flies which they develop into have also a strong resemblance to each other, a doubt arose how many kinds might be at work.

Early in the past summer, therefore, Mr. Malcolm Dunn forwarded specimens of maggots from Cauliflower roots to Mr. R. H. Meade, Bradford, who after rearing them to development, favoured me with the information that they were the *Anthomyia floralis* of Fallen (a small fly variously marked with black and gray), of which the male closely resembles the figure given above at 4 of *A. radicum*.

This kind (*A. floralis*), known in Germany as the Radish Fly, is recorded as having been found in the maggot stage in the roots of the common garden Radish, a circumstance which may explain attack occurring to Cabbage roots on ground where Radishes have been extensively grown It was also reared by Mr. Meade this year from maggots found in earth round partly-decayed Clover roots. Remedies found serviceable, in cases where it attacks Cabbage, were mentioned in the Report for 1881, pp. 8—10.

Cabbage Moth. *Mamestra Brassicæ*, Linn.



MAMESTRA BRASSICÆ, Linn.
1, Moth; 2, caterpillar; 3, chrysalis.

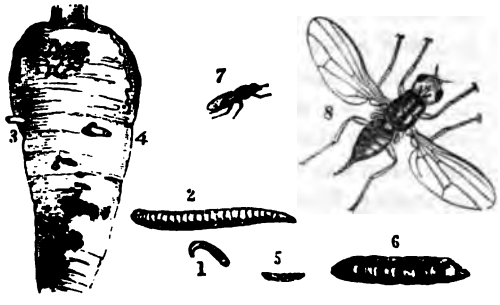
Mr. Hart, writing from Park Farm, Kingsnorth, mentions the caterpillars of this moth as having caused some harm to hearted Cabbage, but that they were not abundant.

In my own garden there was a little injury also to hearted Cabbage, but this was less to Cabbage in rows amongst other plants (as between Celery trenches) than where the Cabbage was in a bed.

Clearing off such of the lower leaves of the Cabbage as lay on the ground appeared a very serviceable plan. Many of these leaves are partly decayed and have ceased to be of much value to the plant, and they not only afford a convenient shelter by day to caterpillars, slugs, or other night-feeding plant vermin, but help to give the easiest possible access up to the food.

CARROT.

Carrot Fly. *Psila rosæ*, Fab.



1, 2, and 3, Larvæ, nat. size and mag.; 4 infested Carrot; 5 and 6, pupæ; 7 and 8, Carrot Fly, nat size and mag.

Mr. James Kay, Bute Estates, Rothesay, mentions that in early spring he sowed a bed of Carrots, which appeared to grow all right until about the middle of June, when there were evident signs of the Carrots in the centre of the bed being affected by wireworm, these making such rapid progress that the whole crop seemed certain to be destroyed. No further attention was paid until about a fortnight later, then, on looking again with a view at least to kill the wireworms, salt was hand-sprinkled over the infested part, and watered with paraffin water to make the salt effective at once. This application, made of course with the knowledge that it was strong enough to kill all it came in contact with, proved very successful. The wireworm attack seems to have been stamped out, as the portions at the end of the bed which were uninfested previous to the application have remained fresh and green up to the date of writing.

Mr. W. Ward, writing from the Gardens, Stoke-Edith Park, Hereford, advises—In preparing ground for Carrots, manure the ground well with good rotten manure; mix at the rate of two bushels of quick-lime to one bushel of salt; incorporate well together, and spread this thickly on the soil or manure, then, in digging, mix these ingredients well with the soil.

At the time of sowing the Carrot seed cover the surface well with quick-lime, draw drills in which to sow the seed, tread soil in upon the seed, and rake the whole over with a wooden-toothed rake, and if the soil is light roll well in addition. This applies equally well to Turnips, and if more lime and salt were used in the preparation of the ground for the Turnip crop, I think the returns would be adequate to the outlay. Of course, in field culture it becomes a costly affair.

Mr. Grierson mentions that at Torloisk, Isle of Mull, the fly did little or no damage to the Carrots. He prepared the ground as he mentioned, p. 21, Report 1880 (that is, had it trenched about two feet deep, and a good layer of farm manure placed at the bottom of the trench in the previous winter. In the spring, after the ground had been prepared in the usual way, deep holes were made about eight inches apart, and filled with a compost of good soil, stimulating manure, soot, &c., and a few seeds placed in each hole)—and the Carrots have turned out an excellent crop.

At Kingsnorth, Kent, Mr. Hart mentions that he had the worst attack of the Carrot grub that he ever experienced on his garden Carrots, but his field crop was quite healthy.

Mr. Freestone, writing from Manor Park, Forest Gate, mentions his Carrots were affected in a manner he had not before observed. The foliage turned yellow in June and July, and when pulled slightly the plants came up easily, the points being black and rotten, as if they had been attacked by an insect. This was probably from attack of Carrot-grub.

CHERRY.

Cherry Aphis. ? *Myzus Cerasi.*

Mr. Hart notes that two of his Cherry trees near Kingsnorth, Kent, were smothered as usual with the Black Cherry Aphis, or Dolphin; and although the trees were cleansed with suds, paraffin and water, or pure water, the fruit was of an inferior quality. Similar trees facing north-west on the opposite side of the house are never attacked, and the fruit is very fine.*

CLOVER.

Clover-root Weevil. *Sitona puncticollis*, Steph.

On the 6th of April I received an enquiry from Mr. R. W. Christy, of Boynton Hall, near Chelmsford, relatively to a small grub which destroyed the roots of Red Clover. He mentioned that under every one of about fifty diseased plants, which he had examined on the 23rd of March, he found two, or three, or sometimes more, small white grubs. Most of these were to be found at or near the tap-root of the Clover, and some at the extremity of the smaller roots which showed injury from their gnawings; in some cases large holes had been eaten, and in all cases the part thus injured had turned black.

On examination of a great many more Clover plants on the 10th of April, a still larger number of grubs were to be found under them; in some cases as many as five or six under one plant. In no case was a diseased plant to be found without a grub, but no grubs were to be found between the rows of Clover; and where the plants had died or withered no grubs or chrysalids were to be found. The Clover land in question was a large field of twenty-four acres, twelve of which were in Wheat and twelve Barley last year (1881); and it was observed that the grubs were much more plentiful on the solid Wheat land than on the looser Barley land.

These grubs or larvæ, when full grown, were about a quarter of an inch long, legless, and much wrinkled; of a whitish colour, with ochre-coloured head, and dark brown jaws. Some of the specimens

* Plum trees were much injured, from their leafage being destroyed by the gale of April 29th; and when the fresh leaves were thrown out these were severely attacked by Aphides. Owing to the manner in which this attack causes the leaves to curl, it is very difficult to bring any application to bear on the insects within.

forwarded on the 10th of April ceased feeding, and formed hollow chambers in the earth by the 8th of May; and at the end of May and beginning of June some of them were turning to chrysalids. By the 26th of June they were numerous in the ground in the Clover field at Boynton Hall, most of the grubs or maggots having apparently changed by that time. The weevils from the earliest formed chrysalids began to appear about the 20th of June; the changes to the chrysalis state happened rather later in the field than to the protected specimens.

These Clover-root weevils much resemble the common Pea weevil, excepting in being rather larger, and having a few whitish spots on each side of the central light line, which runs along the body from the head to the wing-cases. (See fig., under heading Pea Weevil.)

It has long been known that weevils of one or more species of *Sitones* frequented Clover, and maggots (sometimes known as "white maggots" have been known to be destructive to Clover-roots, but as far as I am aware their history had not been made out until Mr. Christy noticed them at their destructive work and secured specimens.

With regard to damage, five acres of Blue Peas had to be ploughed up entirely from this cause, and the other part of the field which was attacked was a very bad piece; the weevils attacked them as soon as they appeared above ground, and kept at them till they were cut. Several farmers were obliged to plough up their Clover leys after the first cutting, the plant being destroyed by weevil maggots. The observer's own Clover recovered after the maggots turned to the complete state as weevils about the beginning of June.

With regard to habits later in the year, Mr. Christy mentions the great numbers of these weevils to be seen about. Every leguminous plant seemed to be gnawed and notched by them, especially in the neighbourhood of Peas and Beans,—"probably when the Beans were cut they flew to the Clover leys, as I have seen great quantities on the wing in a warm day in August. At harvest-time the weevils were abundant on the young Clovers, the platforms of the 'reapers' being literally covered by them, and they could be swept out of the carts when carrying Beans and Peas by thousands."

On the 21st of October it is noted,—"The roots of Clover *now* have no larvæ near them; I have examined a great many." About five weeks later, however, they were again at work—on the 28th of November the larvæ were mentioned as feeding in a Clover field at the present time. Looking at this fact, together with the observation made by Mr. Christy in the spring, that the Clover in the attacked field was dying, *excepting on the spots where the thraves of wheat had stood for a month or more in harvest-time of the previous autumn*, it all appears to point to the quantities of weevils seen in harvest-time then laying

their eggs amongst the Clover, the maggots from which soon appear; but further observation has yet to show whether the greater part of them live as maggots through the winter, or whether they all turn before winter to the complete weevil. This autumn egg-laying appears to be the point to be specially prevented, *if possible.* Where the weevils are in the great quantities reported this year by Mr. Christy, last year by Mr. Hart, sweeping up these legions into buckets of mud or anything that would keep them from flying away, and then destroying them, would do something; but the great thing would be to put some dressing—such as gas-lime, or other application offensive to the weevil, and not in quantity or quality strong enough to hurt the plant—on the Clover.

As far as we see from habits of some other crop-pests, what we need is not so very particularly an application which will keep the insect from going down into the ground to lay its eggs when it comes (though this is highly desirable), but something which will *prevent the crop attracting it to come.* There is a power, answering to our power of smell, in many kinds of insects which draws them in bodies to where their food is, as we see in Turnip Fly going up the wind to a Turnip field; in Gooseberry Sawfly caterpillars crossing a road from one market garden to another; and if some substance is applied, either with a peculiar smell, as above mentioned, or soot, guano, nitrate of soda, or any chemical or other application foreign to what is in any way likely to attract the beetle to lay eggs, and which is also beneficial in restoring "Clover-sick" land, it would be likely to be of great service; and practical observations on this point would be highly acceptable for publication.

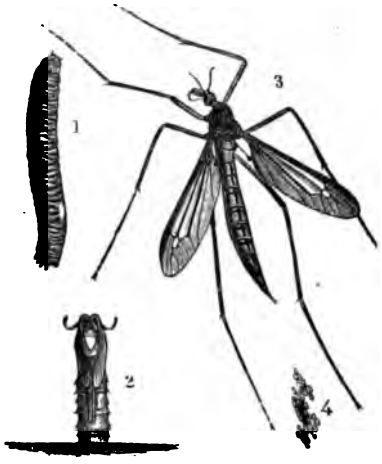
More than one kind of these weevils (scientifically *Sitones*) feed on Clover. Curtis mentions the *S. lineatus* also being destructive to it; and the Rev. W. Clutterbuck, of Long Wittenham Vicarage, an observer for many years, gives a note of the Pea Weevil, *S. lineatus*, having been observed to shelter itself in the top joint of the stubble of Barley, Oats, or Wheat. He says, "We traced the sometimes total loss of the crop of *Trifolium* to this source, inasmuch as we found the insects in the top joint of the stubble, among which we usually drilled the *Trifolium incarnatum* without ploughing. We lightly skimmed the stubble, and so deprived the weevil of its habitat and refuge; and we believe we abated the evil."

Mr. D. Turvill, of West Worldham, Hants, mentions an instance reported to him, in which Peas, having been sown after Clover, were so completely eaten off that the crop was worthless.

For further observations on Clover, Pea and Bean Weevils (*Sitones* of different species), see "Pea Weevil."

CORN AND GRASS.

Daddy Long-legs. *Tipula oleracea*, Linn.*
Spotted Crane Fly. *T. maculosa*, Linn.



1, Larva; 2, pupa-case; 3, fly; 4, eggs.

On the 3rd of April Mr. John Hill forwarded specimens of Daddy Long-legs grubs of various ages from a field of Wheat on light sandy soil. This was sown on the 4th of February, after one year's Clover ley, and had been well limed before ploughing. The grubs were reported to be in thousands, and the ground to be perfectly alive with them. Information was also sent on the 17th of April, from the neighbourhood of Totnes, Devon, of a Barley field, sown about the beginning of March, being destroyed by the Daddy Long-legs grub. In this case the land was rather heavy, and on ley which had been out two or three years. The grubs were to be found in hundreds all over the field and began to eat from the centre. At the time of writing they had hardly left a blade, except a narrow strip less than a land yard wide, round about two-thirds of the field, which they evidently intended to finish.

On the 18th of April Mr. Fletcher, of Felhampton Court, Church-Stretton, wrote regarding great injury being caused to a bed of Strawberries planted in the previous autumn (on land from which a crop of early Potatoes had been taken) by means of a grub which turned out to be one of the smaller kinds of Daddy Long-legs,

* The Leather-jacket Grub being mainly injurious to Corn and Grass crops, the reports of injury from it are placed under the above heading, to which the reader is referred from the headings of special crops attacked.

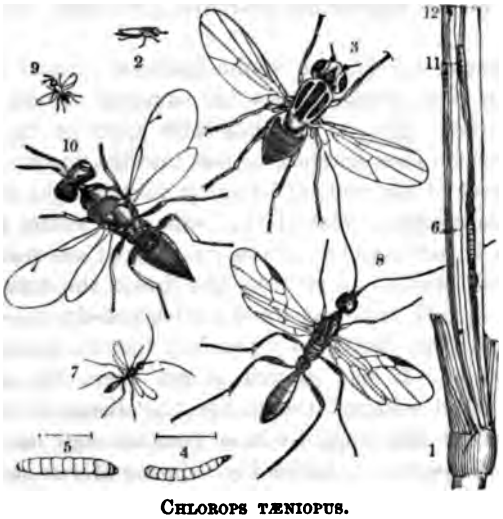
—apparently *Tipula maculosa*. The plants had been top-dressed in the autumn with nearly rotten horse-manure, and at the time of writing were coming through nicely, but about twenty per cent. failed, going off after they had first started. The grub was to be found with its head well into the heart of the young plant, and the leaves all bitten through at the bud.

On remedies being suggested, operations were at once set on foot, by scooping away the soil from every plant; and it was found there were often as many as four or five grubs of different size around a single plant, at work or about to commence. About half of the plants had no grubs at the root, and some that were nearly or quite destroyed had only one.

The hand-picking proved quite successful and did not require repeating, as after the first clearing of the grubs not another plant was lost.

Mr. George Brown, writing from Watten Mains, Caithness, mentions that the Daddy Longlegs grubs were plentiful in the soil, but owing to the rapid start and growth of the corn crop they caused no damage.

"Haulm Fly"; Ribbon-footed Corn Fly. *Chlorops tæniopus*, Curtis.



CHLOROPS TÆNIOPUS.

2-6, Larva, pupa, and fly of *Chlorops tæniopus*, nat. size and magnified. Parasite flies,—7 and 8, *Cælinius niger;* 2 and 10, *Pteromalus micans*, nat. size and magnified; 1, 11 and 12, infested Corn stem.

Mr. Hart gives the following note regarding the presence of this corn-stalk maggot in a part of one of his fields at Kingsnorth:—

"I had some Oats slightly injured by this attack, on a piece of ground that has suffered from it more or less every time I have attempted to grow Oats (or Barley) there. The last time Oats were sown the crop was entirely destroyed. Now a narrow strip across the field was attacked just about where I grew Potatoes last year, but there being abundant moisture, the plant survived and produced a fair crop, though it was somewhat later than the rest of the field. It is singular that a narrow strip should be attacked in this way and the rest remain clear."

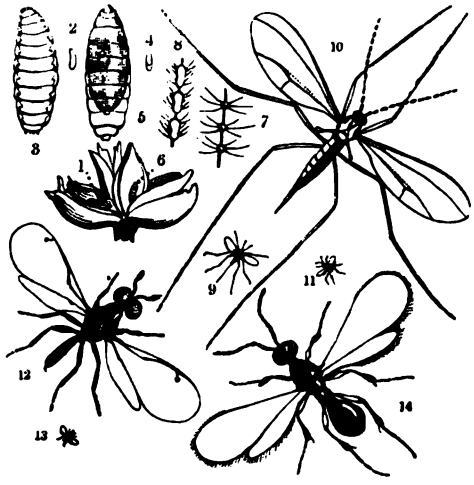
This fly appears to be without an English name of a serviceable kind; I have therefore ventured to suggest above the literal translation of one of its common German names—the "Haulm Fly." This does not confuse it with any other of our crop flies, and is very descriptive, as the presence of the attack is known by the distorted state of the *haulm*, the stem being commonly stunted or swollen at the joint, with the ear in the case of Barley (which the fly particularly frequents) even at full growth still sheathed in the leaves, within which the stem, below the ear, is furrowed down to the first knot by the grub. The attack of this fly has been noticed in wet patches, as on one or two acres of the wettest part of a field, or along the water furrows. I have also seen the injured haulm on wet, poor land, and also near grassy headlands. The following notes, from German observations, give a reason for the appearance near wild grass land, and hint as to treatment:—

It is observed—in answer to the question, Where do the flies come from in the spring?—that the autumn brood have been found to lay their eggs on the late-sown Corn or on wild Grass. The maggot, which soon hatches, pierces into the inside of the plant down to the neck of the root, and there it winters; the attack at this time is not noticeable. Next spring, when the young plant starts, the part that is not attacked grows on straight and tall, hiding the diseased growth, which is something like that of the diseased summer haulm,—that is, with wide leaves and a thickened shoot,—but from the different state of the plant is not precisely like what is observable in the grown crop. If this growth is cut open, the maggot will probably be found within. Commonly the diseased leafage (it is stated) dies, whilst the maggot within goes through its changes and comes out as the perfect "Haulm Fly" during March and April, and soon begins the egg depositing and producing summer attack.—From observations by Professors Nowicki and Konopka, quoted in 'Prak Insecten Kunde," Dr. E. L. Taschenburg, Part IV., pp. 148, 149.

The remedies that suggest themselves from the above notes and our own observations appear to be, clearing away wild grasses, taking measures to prevent the soil being sodden or poor, and as the

wintering of the grub in the young Corn appears to do little harm, to prefer winter-sown corn to sowing in spring, when the Haulm Flies, hatched out of their winter quarter, are ready to lay, and cause in some cases (notably in 1841 and 1846) much injury to the summer crop.

Wheat Midge; Red Maggot. *Cecidomyia tritici*, Kirby.



CECIDOMYIA TRITICI.

1, Infested floret; 2-6 larva and cased larva (pupa?) nat. size and magnified; 7-8, joints of antennæ, magnified: 9 and 10, *C. tritici*, nat. size and magnified. Parasite flies,—11 and 14, *Platygaster tipulæ*; 12 and 13, *Macroglenes penetrans*, nat. size and magnified.

At Park Farm, Kingsnorth, Mr. Hart mentions that the Wheat d ge was not nearly so abundant as it has been for several years past, but still too plentiful in White Wheat; and he mentions that he still takes the precaution *to burn the dust* that falls beneath the threshing machine, in which may be found the greater part of the Red Maggots which the crop contains.

Mr. Russell Swanwick notes regarding the Wheat Midge, that it did somewhat less damage than of late years at the Royal Ag. College Farm, Cirencester, owing to its appearing a fortnight later than usual in comparison with the flowering time of the Wheat, and hence allowing the grains to become formed before the grub could feed on the sap.

Even in these improved circumstances the damage cannot be put at less than 15 to 18 per cent., or over a sack per acre on 70 acres; a loss therefore of £70.

In previous years, from and including the summer of 1878, when first noticed, the damaged florets in which the grain was entirely wanting have been from 30 to 40 per cent., entailing a loss of about three sacks per acre, or roughly £4; or as nearly as possible a loss on the Wheat of half a crop. It is remarked,—"My neighbours would not at first credit my estimate of the damage, but on more careful examination they agree with me in its extent. There is no doubt that this neighbourhood has suffered more than most of late years, for (nowhere that I have been) have I noticed so much red and yellow chaff scale in the husk."

Prof. Allen Harker notices the Wheat Midge as being out in myriads egg-laying on the Wheat, at the Farm, Royal Ag. College, Cirencester, in the evening, at the beginning of July; and this precise date, together with Mr. Swanwick's observations of the late appearance of the Midge relatively to date of flowering enabling the grain to be so far formed as not to be suitable to the maggot, is of much interest, as confirming what has been remarked both here and in American and Canadian husbandry. These show that where (by management of date of sowing on the other side of the Atlantic, and in this country undesignedly through influence of weather) the appearance of the Wheat Midge and that of the Wheat flower differ in date, we have much benefit. If, as above, the embryo Wheat is too much formed to be serviceable to the just-hatched maggot, the creature starves; if, on the other hand, the Wheat blossom instead of the Midge is late, we benefit just in proportion to the numbers that perished before our crop was ready for them to lay their eggs in.

Wheat-bulb Fly. *Hylemia coarctata*, Fallen.*

Early in June of 1881 a communication was made by Mr. W. Creese, of Teddington, regarding loss which he had suffered for many years in his Wheat crop, by means of a maggot feeding in the young plant.

The attack was observable early in March, or in mild seasons about the middle of February, at which time the maggot was so small as to be hardly perceptible. Its place of feeding was just at the base of the stem, where it remained for a short time and then moved off to another shoot, and by the beginning of June the maggots had usually disappeared.

* Notes on this subject were given in the Report on Injurious Insects for 1881, but we were not able then to make out which of the Fly maggots present did the damage; part of the life-history is therefore repeated.

The specimens of young Wheat plants forwarded were for the most part so much injured by the gnawing of the maggot that they were consequently decaying, and, though the severe nature of the attack was plain, there was difficulty in making out the kind of fly which caused it, for very few maggots or chrysalids then remained. Of these the only one that developed to an injurious insect proved to be either of the *Oscinis frit*, the Frit Fly itself, or of a nearly allied species; but whether it was the above or *O. vastator* (which is considered by Taschenberg to be the spring form of *O. frit*, feeding in the Wheat bulb, whilst the autumn brood feeds in the ear), it was of interest as showing the presence of such an injurious fly. Still such a small quantity of it was present that it was by no means certainly the cause of the attack, and further specimens were requested. Young Wheat plants were accordingly forwarded by Mr. Creese, at the end of March of the present year (1882), with maggots then feeding inside the stalk, just above the bulb; and I am permitted to state, on the authority of Mr. R. H. Meade, who watched the progress of these larvæ up to their development on May 27th, that they are the maggots of the two-winged fly, known scientifically as *Hylemyia coarctata* (of Fallen).

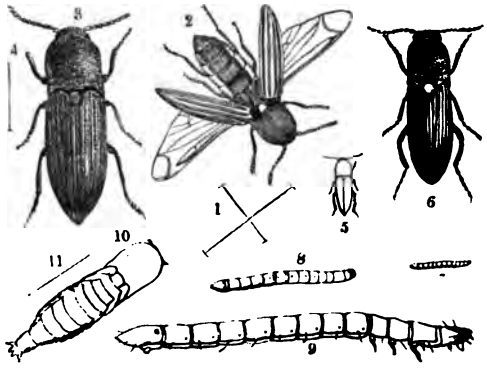
This is a small fly, not unlike the Onion Fly in general appearance. The females are pale ash-grey; the males have body between the wings (*thorax*) grey and lighter at the sides, with a faint stripe along the centre, and the abdomen, which is long, narrow and flat, ash-colour also, with a faint line along the back.*

The maggots or larvæ are whitish and legless, much like those of the common Blue-bottle Fly in appearance, and when full grown are upwards of a quarter of an inch in length; the pupæ or fly-cases are chestnut-brown.

With regard to habits and amount of injury, it is mentioned by Mr. Creece that the Wheat-bulb maggot is entirely absent in some seasons, but is very destructive in about three years out of four; that it attacks plant on land which has been fallowed in the previous summer, but does not ever appear on land ploughed for the first time in the autumn; also that it "always leaves a belt of five or six yards near the hedge untouched." The damage is sometimes so complete as not "to leave a healthy plant in a yard," and in 1881 the destruction by Wheat grubs was at the rate of 15 bushels per acre in 50 acres of fallow Wheat.

* For full description see "List of British *Anthomyidæ*, 16. *Hylemyia*," by R. H. Meade, 'Entomologists' Monthly Magazine,' 1882, p. 269.

Wireworm and Click Beetle. *Elater* (*Agriotes*) *lineatus*, Curtis; *Elater* (*Agriotes*) *obscurus*, Curtis.



AGRIOTES LINEATUS.

1 and 2, *Elater lineatus*; 3 and 4, *E. obscurus*; 5 and 6, *E. sputator*, nat. size and magnified; 7, larva of *E. sputator*; 8 and 9 larva (wireworm) of *E. lineatus*, nat. size and magnified; 10, pupa (lines show nat. length).

The following report on Wireworm, from notes contributed in reply to a circular issued by the Council of the Royal Agricultural Society, requesting information as to the habits of Wireworms and methods of prevention of their ravages, was compiled by myself, as Consulting Entomologist of the Society, and published in their Journal for 1883, vol. xix., part 1, and is now reprinted by permission of the Council.

For convenience of reference the communications received have been divided into paragraphs according to the subjects to which they mainly refer, and classed under special headings, the name and locality of the contributor being in each case appended to the information furnished. The series is thus arranged so as to run on continuously from the commencement of remedial measures (in the breaking up of pastures or leys), by which egg-laying may be prevented or the Wireworm killed, to the various methods of treatment of soil, or kinds of crops calculated to prevent or forestall attack, and further notes of various kinds of manures and applications which have been found to check attack when present.

It will be observed that two of the points mainly brought forward are, the importance of compressing the ground (by methods varying according to the nature of the soil and condition of the crop), so that the Wireworms may not have free passage in the land; and also of maintaining such a vigorous growth as may carry the plant over the injury caused by an average attack.

The past season having been generally favourable to plant growth, it has turned out that though Wireworms began to run early in the

season, yet that the crops have suffered less than was threatened, and notes of serious damage have only been returned from a few districts. Therefore, injury not being prevalent, few estimates have been given; the following communications, however, give some idea of the power of the Wireworm when present in the crops.

Estimates and Notes of Amount of Injury.

The extent of injury and money loss from Wireworm is difficult to assess, but on my farm of 1000 acres (Old Alresford, Hampshire), I do not think I shall be far wrong if I value the loss from Wireworm, on 350 acres of Corn, in an average of seasons, at not less than £2 per acre, or £700 per annum, There is also much damage to the root crops, causing further loss from the poorer condition of the crops, owing to the less time the sheep are on the land. I am sure the loss on most Hampshire and South Wilts farms is quite equal to the rent.

My chief experience of losses caused by Wireworm was whilst farming in the parish of Old Alresford, Hampshire, the damage done in this county (Gloucestershire, neighbourhood of Cirencester) being nothing to compare to that on the light chalky soils of the southern counties. Sainfoin being one of the best crops for such soils, together with old leys, a large proportion of the land is taken up with them, and being the breeding-places of the Wireworms for years together, naturally, on breaking them up the succeeding crops suffer much.—(T. R. Hulbert, North Cerney, Cirencester.)

Concerning damage from Wireworm on a field of 15 acres, the first crop injured was of Turnips, which were worth at the least £6 per acre; and half the crop was destroyed by the Wireworm, which would make the loss £45, exclusive of labour. Last year (1881), it had Wheat grown upon it which ought to have been 10 bags to the acre (72 lbs. to the bushel); instead it was only 2 bags; so consider the loss to be 8 bags at £1 1*s*. per bag, which would be £126.

The consuming price of a ton of straw lost per acre would be about £1, or loss on this item on 15 acres, £15.

Total during two years would thus amount to—

Loss on Turnips	£45
,, Wheat	£126
,, Straw ,, ...	£15
Total .	£186

(J. Heatley, Passingham.)

I have a 9-acre field of light, sound, gravelly soil, rich and good, which is very full of Wireworms. The injury done is very serious, being about 5 bushels per acre in the patches where it is taken.—(J. Prince, Foston, Derby.)

In some fields Wireworms often spoil half the crop of Wheat.—(G. Burgiss, The Farm, Struthergleu Park, Petworth.)

We have suffered much from Wireworm on the chalk lands during the last two or three years, but not as much during the present one.

On the clay lands we have not suffered to the same extent as upon the chalk, except in cases where we departed from the four-course rotation and sowed Wheat after a two years' ley. I attribute this partly to their having been in Clover for two years, and partly that being undrained we have to ridge up the field in small lands, which prevents the roller taking proper effect.—(A. H. Bowles, Clandon, Guildford.)

Wireworms have not troubled us for several years past, but previously they were a source of great injury in loss of Oat crops, and Turnip crops. Probable money loss no one can tell accurately.—(J. Forrester, for Right Hon. Viscount Portman, Bryanston, Blandford.)

Injuries are mainly confined to the crops on light, porous soils, except very sharp sands. On land subject to periodical attacks of this pest, my estimate of the average amount of injury is about 1-10th of the crop.—(F. Beard, Horton, Canterbury.)

The Wireworm this year was much better than last. In dry unkindly springs under our chalk hills, the Lent Corn, Oats and Barley suffer much from it.—(R. Cooke, Detling, Maidstone.)

Loss this year on one farm, a quarter of the crop; on another, from a quarter to a half; on another, loss estimated as usually a quarter, but sometimes half the crop.—(per J. H. White, Weybread.)

The Wireworm has this season been a great pest in the Fens, and also on high lands.—(C. Caswell, Peterborough.)

On one of the farms which I occupy, I lost, when first I took it, an entire crop of Wheat—money loss, rent, rates and taxes on the field, also seed and labour of putting in.—(C. R. Colville, Burton-on-Trent.)

Scotland.—Wireworms have done great damage in this district this season. Some fields of grain were ploughed down last month (May) and resown, so that there will not be such a great loss; but there are many more in which the Wireworms have not left half a crop, and the loss in consequence must be 50 per cent.—(M. Dunn, Dalkeith.)

I have 17 acres of Barley injured this season by Wireworms; taking the average loss over the field at 2 quarters per acre, this is £3 per acre, present market price.—(D. Husband, Struthers, Cupar, Fife.)

Wireworms have (as usual) been rather numerous, particularly amongst lea Oats, and have kept back the crop from ripening early. Consequently, where Wireworm have abounded, a good many farmers have not yet (Oct. 6) got all their crops into the stackyard, and they deteriorate by long exposure.—(T. Dow, West Idvies, Forfar.)

In the Isle of Man, though the Wireworm attack is for the most part less than usual, yet estimates of amount of damage at various localities run as follows :—

1 boll to the acre on Oats; about 2 bolls* per acre, or about a quarter of the crop of Wheat. Half a crop of Turnips; 6 tons of Turnips where 15 tons were expected; 1½ tons of Turnips, 1–8th the expected crop lost per acre; and a loss of £10 per acre on Carrots in a previous season is noted, per P. M. C. Kermode, Ramsey.

If we look now merely at the amount of injury named in the foregoing estimates, beginning at the lowest direct loss stated, we find two instances of this being about an eighth of the crop; one of loss of two-fifths; two of a quarter; two of a quarter to half; and four mention a loss of half of the crop. Two entries give notes respectively of the entire loss of a field of Wheat, and of crops having been ploughed in. Of the others of the 17 returns which give definite amounts of loss, one is at a rate of 5 bushels, another of 2 quarters per acre. An average of loss near Canterbury places it at one-tenth of the crops; and another, giving the average of money loss on 350 acres of a 1000-acre farm in Hampshire, places it at £2 per acre, this last not including loss on roots or further loss consequent thereon.

This gives some slight idea of what the Wireworm can do in the way of injury per acre; and it should be remembered that when it has injured one crop its work is by no means done.† It lives on for

* A boll of Wheat in the Isle of Man is 4 bushels, at 64 lbs. to the bushel.

† Wireworms are the grubs or larvæ of the small beetles commonly known as "Skip Jacks," "Snap" or "Click Beetles," from their habit of flying up in the air with a kind of snap or click, when laid on their backs, and thus regaining their natural position. Like other beetles, they pass through three stages (larva, pupa, and complete insect), but they differ from many kinds in the fact of continuing in the grub or larval state (that is as Wireworms) for many years; the pupal or chrysalis stage appears only to last in summer for a very short time, a fortnight or so. The change to this state takes place at a considerable depth in the earth, and many of the beetles come up from the pupæ or chrysalids in July and August; but it is considered that some probably pass the winter in this condition and come up with the return of warm weather in the next season.

The Click Beetles are of many kinds, and are commonly from about a quarter to half an inch in length, and of a breadth of about a third of their length, and brownish in colour, with a pair of long horns and six legs—the Wireworms are commonly of a straw colour, and of the shape figured at page 22; when examined very carefully they will be seen to have six little legs like claws, one pair on each of the three rings nearest the head, and by having *six* and *no more than six legs* they may be easily distinguished from Daddy Longlegs grubs, which have none, and from Julus worms, millipedes, centipedes, &c. which have many, and which are often confused with the true Wireworm or grub of the Click Beetle. From the habits of the beetle and the locality where the young Wireworms are found, there appears to be little doubt that the eggs are laid either a little below the surface of the ground, near the food plants, or amongst the leafage just about the ground level.

many years, for five years so far as we know, feeding the whole time (excepting when it may go down deep for shelter in the winter) on almost any crops, and, failing them, on grass roots or what it can find.

Some parts of the country, as the Orkneys, and part of the Scottish Seaboard and Islands, appear to be little troubled with it, but it is widely spread, and one of our pests which is never totally absent; and looking at the acreage under crops which it particularly attacks, as Wheat, Barley, Oats, also Hops, Swedes and Turnips, Potatoes and Mangolds, amounting as stated in the Government Agricultural Returns for 1882, to 8,406,709 acres in England only, each farmer can see for himself the vast cost of entertaining such a guest. The following communications show methods by which its presence may be much diminished and injury from its ravages lessened, in cases where it cannot be wholly got rid of.

Treatment to prevent Egg-laying to destroy or starve out Wireworms.

Observations concerning such treatment of pasture or Clover ley by close grazing, treading with sheep, dressing with lime, gas-lime, salt, and nitrate of soda, &c., as may best prevent the Click Beetles from laying eggs, or which may destroy such eggs or Wireworms as may be in the soil, before the land is broken up. Various methods of ploughing and consolidating the land; also of paring, burning, and cleaning out roots and rubbish, and of cropping and manuring suited to starve out or destroy the Wireworm and promote good growth of the next crop.

Feed down the land as bare as possible before ploughing it, and leave as few stumps of grass as possible or leaves to plough in. I believe a top-dressing of lime, or lime and salt to the land, after it is eaten down bare, and before it is ploughed, would also tend to check the Wireworm. After the land is ploughed, roll it down as tight as possible.—M. Locke Blake, near Ilminster.

In order in some degree to prevent mischief from this pest, it is well to consolidate the surface thoroughly, and to graze every bit of plant off all leys or pastures which it is desired to break up. For this purpose sheep and cattle should be fed with cake, corn, or other feeding stuffs, so that each inch of land shall be trodden and eaten bare. By this means the grub would be destroyed, or if it escaped being trodden to death it would find great difficulty in obtaining food, both through the scarcity of vegetation and the solidity of the surface soil.

A dressing of gas-lime on the surface and ploughed in, has a good effect on any of the worms which may have escaped the treading and starving.

On land suspected of containing this plague it is advisable to sow

the crop broadcast, in preference to sowing in drills, as the worm has been observed to follow the drill-mark with great regularity, and crops sown in drills have been found to suffer much more than those sown broadcast, the reason being the greater facility with which the grub finds a new plant when it has eaten the old one.—(Adam Lee, for The Right Hon. the Earl of Powis, Lydbury, North Shropshire.)

IRELAND.—We have no Clover leys here, but we have considerable trouble with Wireworms in old grass leys. I treat them as follows:—

If the lea is broken for Oats (our general crop), it is sure to be attacked more or less by Wireworm; I top-dress with 4 cwt. agricultural salt, 2 cwt. superphosphate, and sometimes 1 cwt. nitrate of soda. I have never found this to fail if applied in time. If the lea is broken in the autumn, to have green crops in the following year, I have the land worked as much as possible, and apply 8 tons hot lime to the statute acre; lime as hot as possible. I always sow the seed with a liberal dressing of farmyard dung, for such crops as Mangold, Turnip, Cabbage, Carrot and Parsnip, and I use the following dressing of artificial:—2 cwt. best bone meal, 1 cwt. nitrate of soda, and 3 cwt. common salt. I find the plants are soon forced up beyond the reach of damage.

On the old red sandstone formation I find lime absolutely necessary. I do not think 8 tons per acre is quite enough, and would use 10 tons if I could procure it quickly. That, and also common salt, will reduce most of these pests, and nitrate of soda in small quantities is most useful to force on almost any crop.—(Sir Richard Keene, Cappoquin, Waterford.)

Some years ago we suffered rather severely in this neighbourhood (Ballinacourte, Tipperary) from Wireworms, but since adopting the following system of top dressing previous to ploughing, the Wireworm has ceased to trouble us.

In preparing lea for Oats, I either top-dress the surface with lime or by sheep. When by lime, I prefer to draw the lime daily as it leaves the kiln, and put it down in heaps which I cover with earth. The heaps are small and placed conveniently for spreading. They are allowed to remain until the stones are pulverized, and then the lime is spread in the hot state over the surface. The effect of hot lime is to burn off the grass, and thus to destroy the food of the Wireworms; also when (as is well known), they come to the surface after freshet, they do not do well amongst the lime. Further, I am of opinion that this system of top-dressing has a good effect in destroying eggs from which Wireworms would have hatched. I use from 60 to 80 barrels of lime (measured before being pulverized) to the Irish acre.* Top-dressing by sheep-folding involves a system

* 100 Irish acres are equivalent to 162 English acres, consequently an Irish acre amounts to about one acre and three-fifths, English measurement.

of farming which I think could be extended with good results to Ireland.

My method is to pen such of the flock as are intended to be fattened during the winter upon the field. The size of the pen depends on the number of sheep and the extent of land to be top-dressed. I begin at one side of the field, and enclose as much ground only as will be thoroughly trodden in one week, removing the pen regularly once a week. The ploughs follow the moving of the sheep, so that the system does not retard the spring ploughing, as by the time the last of the sheep are sold off and the last move made of the pen, the field is within a day or two of being ploughed. The sheep are fed with Turnips, Oats and Hay.

This is a perfect method of manuring the field. The braird comes up strong and healthy, and very soon places itself beyond the ravages of the worm; but the secret of success is in doing the work thoroughly. I use 15 stone of seed per acre of Oats and 12 of Barley, employing a heavy roller as soon as the braird is above the surface.

I may add, that three years ago a field of 7 acres was, as an afterthought, ploughed without having undergone any system of top-dressing, and it was almost entirely destroyed by Wireworms. In fact, the produce in Oats from the entire field was only 1004 stone, when we calculated on 300 stone per acre.—(S. Sym Scott, Ballinacourte, Tipperary.

I have for the last 10 years here grown from 45 to 60 Irish acres of Turnips. My system of cultivating them is to plough deep in autumn, leave it exposed all the winter, until the proper time in spring for preparing for green crops, when I first harrow down the winter ploughing, then grub deep with three or four horses; again harrow and pick off any weeds. Grub again with a light grubber drawn by two horses, and harrow and roll if required, and this is generally all that is required. Before opening the drills I like to leave the ground that is prepared a few days in dry weather, before working, so as to draw a little moisture. A man with a pair of horses then opens the drills, others cart in the farm-yard dung, while another set of men and women spread the manure and sow the artificial manure, another man with a pair of horses closes the drills, and a man with a pony sows the Turnips and does odd work in the field.

I mix mould or ashes amongst the artificial manure and salt on dry soil before sowing it. The farmyard manure I get turned over if possible ten days or a fortnight before using it, and saturate it well with liquid manure, so as to have it in proper order; I also mix the Turnip-seed before sowing with flower of sulphur, which is a great preventive against the Turnip Flea or Fly. I never have, as yet, had to sow Turnips secondly, and we have always very heavy crops. I

often skim and clean stubble for Green crops, and plough in the farm-yard manure, which is a good plan in dry, hilly land, and saves much spring labour.—(William Stoddart, Steward for Lord Clermont, Clermont Park, Dundalk.)

I have been farming on gravel land on the four-course system, feeding off the roots by sheep on the land, and thereby treading it. As the growth of Clover as often as every fourth year encourages Wireworm, and the land is liable to become clover-sick, I have occasionally (when I had any cause for alarm) substituted Beans or Peas on about the worst half of the land for clover; the other half the same, next time. By this means, and by firming the land, and getting it into good condition by manure, the crop is better able to stand attack of the Wireworm.—(Richd. R. Ridler, Moreton on Lugg, Hereford.)

As a rule I always plant Oats or Dredge (the latter a mixture of Oats, Barley, and Peas), as I find the Peas fill up should the Wireworm thin the Oats too much. Care should (I think) be taken not to plough the ley-grounds too long before planting the Oats, &c. If the land gets too stale, *besides getting grassy*, experience tells me the crops suffer most; therefore I prefer not ploughing before the beginning of the New Year, for sowing in February. I also prefer sowing the corn broadcast on such ley ground, giving it as many as seven double turns with the harrows, and then rolling it. When drilled I fancy the Wireworm follows the drills more quickly.

The chief damage generally arises on the succeeding crop; after the Oats I generally sow Vetches, the next most certain crop, and least liable to the attacks of the Wireworm. After being fed off and the land planted with turnips the same season the roots generally fail; also the succeeding crop of barley is sure to be much injured.

The good old plan of *Paring* and *Burning* (Breast Ploughing) old Sainfoin and Seeds is the best way of preparing such land for any future crop, as it destroys many of the eggs, &c., but the increased cost and the scarceness of labour render the plan often impossible.—(T. R. Hulbert, North Cerney, Cirencester.)

* My opinion as to why the Wireworm attacks the second crop more than the first is, that it is in consequence of the mechanical state of the soil. When ploughed after old ley the furrows come up very tough, and after being well rolled and harrowed are so consolidated together that it is difficult for the Wireworm to make a fast progress. Also there is other food (old roots) plentifully at hand. This is proved, I think, by ploughing early, and thus letting the old roots rot too much before planting the crop; consequently the Wireworm at once

* The following note was received in reply to enquiry regarding presence of Wireworm sometimes occurring in larger amount on the second crop than on the one immediately succeeding broken up ley.—(Ed.)

begins the new crop for food, and thus it suffers more. With the second crop the land is generally properly cleaned ; the cleaner it is the more hollow and loose the land becomes, and the more the Wireworm attacks the crop, it being easy to get about, and nothing else to feed upon.—(T. R. Hulbert.)

We have had no Wireworm attack except on one piece of 5 acres of Barley, which was almost entirely spoilt, rolling heavily being of no avail. This was old meadow land, but perhaps it is worth notice that about one acre of this field, which was *burned* about five years ago, was not nearly so bad as the other four acres. Fires were made about 11 yards apart, and all the rubbish, weeds, roots, &c., burned, and the ashes spread about the land.—(R. W. Christy, Boynton Hall, near Chelmsford.)

Probably there is more Wireworm in Wheat after seeds than at any other time on the four-course system.

The special management is to plough the seeds up soon enough to give the turf time to rot ; by rollings to give a firm seed-bed, and by rolling *after* putting in the seed (where this is practicable) to compress the soil with a view to preventing the frost lifting the surface, and so injuring the young plant. The judicious use of fertilizers strengthens the plant, and generally enables it to resist alike the effects of frost and the ravages of the Wireworm.

On land where, after seeds have been grazed for two or three years, the ground has been ploughed for Wheat in August (giving time for the turf to rot), and a firm seed-bed has been secured by plentiful rolling, also some fertilizer such as Guano or Superphosphate sown at the time that the seed is drilled, we shall not find any unusual amount of Wireworm. If, on the contrary, it is ploughed later in the season, and the land treated only as in the case of one-year-old Clover, the poverty of the surface will be shown by the large proportion of dead plants which have "damped off," whilst the remainder "slow growing" will show Wireworm active amongst them.

In ordinary cases—cultivating the land immediately after harvest, burning all Grass and other roots carefully, and so destroying the eggs of the Beetle—repeated ploughings, which enable the rooks to carry off a large percentage of the Wireworms, and a thorough pulverizing of the soil, which may expose them, appears to me to be the effectual way of dealing with the Wireworms, or larvæ of the Click Beetle.—(Ralph Lowe, Sleaford, Lincolnshire.)

Wireworm is especially destructive after two years' seeds, more particularly when the land is sown with corn immediately after ploughing, and so little worked that considerable spaces are left between the unbroken furrows. Early ploughing Clover Ley in the autumn and rolling the Wheat or Oats in the spring has been very advantageous,

but we attribute this rather to the solidity of the land, which enables the roots to work better, than to the destruction of the Wireworm.

During autumn last year we used gas-lime on Clover Ley before ploughing up for Oats, and, whether from that or from some other cause, there was no perceptible injury to the following Oat crop.

On a farm which I formerly had in hand, but which I let some years ago, there were when first I began to occupy it a great number of Wireworms. These almost entirely disappeared in the course of a few years, and we attributed this fact to the more thorough cultivation and working of the land. My Bailiff suggests that the removal of weeds, especially "twitch," in which the Click Beetle may have laid its eggs, is perhaps the cause of this. It is certain that the Wireworm is fast disappearing from the farm I now occupy, and we have found no appreciable injury from it this year.—(Joseph Paget, Stuffynwood, Mansfield.)

Breaking up Clovers and Rye Grass is generally done early, so as to insure decomposition of the plant, thus giving full effect to firming of the land by pressing with iron ring rollers.

Treading with sheep where affected, rolling, and harrowing are the means generally adopted. The only manure used as a top-dressing is soot, which is a good remedy for Wireworm.—(H. Hayward, near Hereford.)

I have suffered most in the Wheat crops grown upon the Clover Leys, and the best treatment that I ever discovered was to plough shallow, and after the seed was drilled either roll well or tread with sheep to well consolidate the ground.

Another system I have adopted is to plough the Clover Ley early, and get a crop of Rape or Mustard, feed it off for sheep, and then plough again for Wheat. This method I have found a great preventive for Wireworms, but at the same time by the early ploughing some part of the summer feed is sacrificed.—(Richard Pullen, Slandeford, Wolverhampton.)

Wireworm are most plentiful on land that has lain long fallow, and from old pastures, or from Clover Ley.

The methods of prevention in treating Clover Ley are—judicious fallowing, and such a thorough burning of rubbish as will destroy the eggs and grubs. Heavy rolling and brush harrowing will destroy many of them.

Ploughing the surface two inches deep with a breast plough, the turf being burnt or allowed to die, is recommended.—(John Sutherland, Berridale, Caithness.)

This year I have a splendid crop of Oats on very old ley. I used an American Prairie Plough with revolving mould-board, which brings up the subsoil to the surface. This made the ground easily broken down, and almost covered the sods. I then sowed with fine Rape Meal and

Oats mixed in the hopper, and the crop promises to be earlier than any sown at the same time.—(Chas. Littleboy, Straffan, Kildare.)

The field now in work for Wheat after mowing Clover twice is ploughed deep, then is harrowed well, so as to make the land solid, and keep a good tilth for seed, lime at the rate of four tons per acre worked in with the large harrow, and sown as solid as possible. This produces me the best crop, as the action of the lime converts the turf into suitable soil for Wheat.—(J. Prince, Foston, Derby.)

In breaking old Sainfoin up I sow about 5 cwt. of salt to the acre before ploughing it, and let it lie and get quite stale before planting. If I find any Wireworm I well press it.—(Jas. Bulford, Fordley.)

Salt sown at the rate of about 8 cwt. per acre on grass land before ploughing for a crop is recommended as a preventive for Wireworm. Gas-lime at the rate of about fifteen tons per acre spread on turf or seeds before ploughing has been found a certain cure, and soot sown before ploughing or after sowing is a good preventive, and promotes growth, especially for Wheat.—(Per J. Craig, Shifnal, Salop.)

I believe the best method to get rid of the Wireworm from pastures is to apply a good coat of lime on the surface; an effectual plan is to plough up any land subject to the Wireworm, and mix the lime in the soil, say, at the rate of six tons per acre, after which a crop of Turnips should be grown and eaten off the ground by sheep hurdled up in pens. I have never seen that course a failure.—(Owen Price, Nantyrhain Brecon.)

Importance of Healthy Growth, and Notes on Manures.

Importance of such treatment of the seed and preparation of the land as will ensure healthy germination and vigorous growth from the first, with mention of various artificial manures and applications serviceable for this purpose, and opinions of various observers as to farm-yard manure being attractive to Wireworms.

Wireworm infests pretty nearly all dry, light soils. Its ravages are most fatal where the surface of the land is deficient in plant food; or where the seed used has been weakened from any cause; where the seed has been deposited too deep, or the sowing has been out of proper season, and the plants have to a considerable extent damped off.

In the case of Seed Oats that have been slightly heated in the stack and make no proper progress, the Wireworm will be found to work at its pleasure amongst them; or, again, the Swathe Clover root has been ploughed up late in the season, the turf has not rotted, the Wheat has been put in late, and the work is unsatisfactory. In this case the plant comes up pretty well, but in February it may be found a large proportion have damped off. A dressing of rape cake, or superphosphate, or guano would have prevented this mischief. As it is the

Wireworm has its own way with the remaining plants, and the credit of having destroyed the whole of the crop.—(Ralph Lowe, Sleaford, Lincolnshire.)

If land is in good condition and in a high state of cultivation, Wireworm does not often seem to hurt the crops.—(M. Locke Blake, Ilminster.)

Injury from Wireworm is most severe when the corn is attacked just as the seeds are striking root,—that is, when the food supplies in the grain are exhausted, and the plant is beginning to depend on its roots for nourishment. When the plant has reached the height of six or eight inches it does not fall back so readily under attack.—(Robert Coupar, Old Scone, N.B.)

I observe that when the Turnip plant is attacked in its young state —that is, when about two inches high—that the Wireworm nips into the centre of the root and the plant dies, but when the plants get a little stronger, and one or two fibres begin to spring out from the sides, the plant receives little harm.—(R. Renton, Earlston, N.B.)

The quicker you can get the seed to germinate and grow the less injury the Wireworm can do, but in dry weather and cold nights the Wireworm will do much mischief.

I consider that by sowing 2 cwt. of rape cake per acre the crop may be partially saved, as the Wireworm will feed on this while the seed is growing, and thus get a good start.—(Joseph Addison, Mapledurwell, Basingstoke.)

The application of artificial manure is doubtless an assistance to the plant, by strengthening it, and causing it to tiller out, and so in part to compensate for the damage done.

The Wireworm is most destructive during a cold, dry season, with east wind prevailing; in short, when the growth of the plant is suspended. After a copious fall of warm rain the destruction is seen to cease, and the plant to revive.—(David Rowland, Titley, Herefordshire.)

There seem to be two plans for trying to get rid of the Wireworm—one the starvation of the worm by fallowing; the other by the application of something strengthening to the crop, and, if possible, also injurious to the worm. Rolling and hoeing are resorted to,—anything, in fact, which may push on the crop and disturb the worm.—(R. Cooke, Detling, Maidstone.)

. . . . Having arrested their progress, it is advisable to resort to the most highly stimulating manures, and with no sparing hand, in order to force the remaining plants to such a degree as to enable them to cover the ground, and become sufficiently strong to resist the attack of the worms that may escape from their imprisonment, or may hatch afterwards.

Here again is another point in favour of keeping land in the very

highest state of cultivation, both as to manure and mechanical condition. Weeds should on no account be allowed in anything but a state of infancy, as if permitted to cover the ground they weaken the crops and afford a ready supply of cover and food to the pest.—(Adam Lee, Lydbury North, for the Right Hon. the Earl of Powis.)

Manures, into the composition of which sulphuric acid largely enters, are thought when drilled with Turnip seed to repel the Wireworm, but I do not consider that any caustic manure or rape cake put into the land will in any way affect Wireworm, except as stimulating the rapid growth of the plants.

On light lands probably the application of—

2 cwt. of Rape Cake,	at the cost of	. .	7*s.*
2 ,, Superphosphate	,,	. .	8*s.*
1 ,, Kainite	,,	. .	6*s.*
	Total	.	21*s.*

per acre will be found one of the best fertilizers for Wheat. When sown broadcast at the time of drilling the seed this carries the plant out of reach of attack, and gives a satisfactory return on all light soil. On clay it is useless.—(Ralph Lowe, Sleaford, Lincolnshire.)

If the crops are attacked the best means that I have noticed for saving them is to dress these (white straw crops) with some nitrogenous manures, such as nitrate of soda, by which they are induced to grow away fast from the pest which prefers very young growth.—(Robert L. Pudney, Halstead, Essex.)

The use of artificial manures, nitrate of soda to the corn crops and superphosphates to the root crops, I have no doubt is the proper thing, so as to push the young plants on as quickly as possible.—T. R. Hulbert, North Cerney, Cirencester.)

In a 20 acre Clover ley, dunged and sown with Wheat, a strip right through was attacked rather severely. This was rolled, and *nitrate of soda* was applied, and at harvest this part was quite as good as the rest of the field.—(R. Cooke, Detling, Maidstone.)

The only manure used as a top dressing is soot, and this is an excellent remedy against Wireworm and a valuable manure.—(H. Hayward, Blakemere, Hereford.)

We suffer but little from the ravages of Wireworm in this district. Its effects are chiefly observable where the soil is somewhat poor, and too open and porous. It is considered it can best be kept under by dressing with lime, soot, and salt, and severe rolling.—(Rev. G. T. Blomfield, Norton, Ilminster.)

Turnips sown May 25th were ready for thinning June 20th, but on June 22nd so many of the plants were found to be dying from attack of Wireworm that we did not thin until eight days later, to allow them

to get stronger. Then I believe an eighth part of the plants were destroyed, but as they had been sown very thick there were plenty of plants left, and being fine growing weather at the time they began to do well.

As a stimulus a part was sown with nitrate of soda, 2 cwt. per acre; another part with common salt, 4 cwt. per acre; and another with dissolved bones and guano, 3 cwt. per acre, or thereabouts. It was plain that the nitrate of soda answered best, and the whole was re-sown with it. Now the crop is a pretty fair one, but I believe if nothing had been done it would have been lost.—(R. Renton, Earlston, N.B.)

Observations regarding Wireworm being attracted by Farmyard Manure.

Some farmers consider that spring crops sown on land that has been dressed with farmyard manure are more infested with Wireworm than those sown on land dressed with artificial manures. I think artificial manures are of great use, as on every account it is good to force on the plant at the time the insect is at its work.

In this part of the country (Pen Pont Farm, near Brecon) ferns are used in great quantity by most farmers for bedding purposes, but in one locality it is considered that the Wireworm occurs in such numbers in manure made from ferns that the farmer will not allow a load of these to be brought into his yard, and I have seen Potatoes planted in manure made chiefly from ferns very badly infested by Wireworm.—(Thomas Jones, Penpont Farm, Brecon.)

I have noticed in former years that portions of land which have been treated with farmyard manure have been seriously attacked by Wireworm, while adjoining portions, covered with ashes, road-scrapings, &c., have at the same time been entirely free from them.—(L. P. Williams, Penberry, St. David's.

I think heavy dressing with farmyard manure helps to encourage Wireworm.—(J. Prince, Foston, Derby.)

It is a well-known fact that salt is an effective preventive of Grub and Wireworm in cornfields, and besides is valuable as a fertilizer, and in strengthening straw grown on land deficient in saline matter.

If farmyard manure, and especially stable dung, was turned over and salted in spring, or salted after being spread in the drills previously to being covered, I believe we should have much less Grub of all sorts. —(James Kay, Bute Estates, Rothesay.)

The above points are well worth further observation and consideration, for one great principle of prevention for Wireworm attack is to press the land so firmly that the Wireworms have not free passage in the soil, and it is plain this state cannot be thoroughly attained where farm manure is used in the condition in which it is commonly applied to the soil, and where large quantities of any kind of vegetable matter

that takes long in rotting are added, the difficulty of course is much increased.

Further, it has been observed that the Wireworm of the common-striped Click Beetle, *Agriotes lineatus*, Esch., has been found (and sometimes in great numbers) in dung, and in vegetable manure or vegetable earth; and thoroughly rotted horse dung has been found to be a feeding-place for the Wireworm of the Black Click Beetle, *Athous niger*, Linn., and consequently these kinds, and conjecturally several others (whose habits, as far as we know, are very similar), may thus be easily carried out to the coming crop in the manure.—(Ed.)

Rolling and Treading with Sheep, &c.

Notes of Wireworm being most destructive on light and friable soil, or when land is in this condition from weather effects, such as are caused by long frosts.—Pressure of the land by rolling, or by treading with sheep, or other measures, calculated to compress the soil firmly, and thus keep the Wireworms from travelling, strongly recommended both as methods of prevention, and also as remedies when attack is present.

Wireworm infests land of almost all descriptions, but more frequently those of a light, friable, and dry, or moderately dry, texture. It seems to delight in being able to run freely from one plant to another, and damages all crops more or less, but its effects are never so plainly visible as in the early spring to the Wheat, Barley, Oats, small Turnips, and other plants.

Where measures of prevention have been unthought of, or have failed, and the young crop is attacked, the first thing to be done would be to roll with a heavy flat, smooth roller, or with a Cambridge roller or ring roller first, and a flat one to follow, and this should be done when the land is as wet as it is possible to work the implement on free of clogging, in order to arrest the progress of the Worm from one plant to another.

To drive sheep over it until no part can be seen without a sheep track is also a good plan, but is heavy work for the sheep.—(Adam Lee, Lydbury North, for the Right Hon. the Earl of Powis.)

Rolling after sowing is generally admitted to be the best preventive. By rendering the soil firm and compressed it prevents the ready passage of the Wireworm from plant to plant, and thereby localises the damage.

Where crops are affected rolling or treading by sheep where practicable is a plan universally adopted, and is, I think, the best remedy. —(David Rowland, Titley, Herefordshire.)

Rolling and treading at the time of sowing the seed have been found serviceable.—(Ralph Lowe, Sleaford, Lincolnshire.)

Wireworms are more active in the spring months after a long frost (on account of the land being more porous then) than they are in mild winters.

I have used 30 cwt. of gas lime to the acre on Clover ley, and harrowed the land a week or nine days before being ploughed up for Wheat with good effect, and put the shepherd to drive the *sheep close over* the field when the drill was planted. In March, if the land is dry enough, put *cattle* and *sheep to tread it*, and roll down. I do not think rolling does as much good as the *horses* do in treading, especially if they are driven three abreast.—(G. Burgiss, Farm Manager to the Right Hon. Earl of Winterton, Struthergleu Park, Petworth.)

No doubt in Hampshire the Wireworm is a scourge, but it is not numerous enough here (Downton) to cause us trouble. Our ground is heavily stocked with sheep, and probably their constantly treading interferes with its movements.

Most of our land carries sheep at least once a year, and much of it twice. Vetches *fed*, followed by roots, *fed*, alternated with the ploughings and dressings necessary for the cultivation of the crops, must be an unsatisfactory state of things to the Wireworms.

On poorer soils, where only about half the amount of sheep per acre is maintained, the Wireworm is to be found established more frequently.—(Professor John Wrightson, College of Agriculture, Downton).

Our treatment of land where crops are affected is frequent use of heavy ring roller, and steady driving of sheep backwards and forwards over the land.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

The firmer the land the better; consequently have often used *sheep* on the Wheat land when too wet for rolling. Good cultivation, plenty of harrowing, &c., is always beneficial.—(T. R. Hulbert, North Cerney, Cirencester.)

Treading the ground with *sheep* and *cattle* and *rolling* with a heavy roller are good measures for killing the Worms.—(John Sutherland, Berridale, Caithness.)

If the Wireworms attack a crop the only way I have found to stop them is to get the land into as firm condition as possible; if the land is open they can travel easily from plant to plant, and may often be seen working up a drill and killing all the plants in succession. If the land is firm and hard pressed the Wireworm has more difficulty in working about in it. *Rolling* constantly with a heavy roller, or turning *sheep* backwards and forwards on the ground, is the only way to get it properly consolidated.—(M. Locke Blake, near Ilminster.)

All light land subject to Wireworm ought to be *rolled* twice with a ring roller as soon as the seed is sown, either in the autumn or

spring. You cannot well get the land too firm.—(Joseph Addison, Mapledurwell, Basingstoke.)

On the chalk at Mere Down, Wiltshire, it is noted that the *Cambridge ring roller* is the best remedy, the heavier the better, and that it should be passed over the same land two or three times.—(Thomas Henry Baker, Mere, Wilts.)

I have tried rolling, both with and without salt, and salting without rolling, the two former with good effect, the latter apparently with none. This year being particularly favourable for rolling the Wheat crop, it was all well rolled in good time, and we have not suffered.—(A. H. Bowles, Clandon, Guildford.)

I have suffered considerable loss by the ravages of the Wireworm in my Wheat plant on land where the previous crop was seeds, and the most convenient method for destroying them is to roll the ground, and make it like the turnpike road. The Wireworms come to the surface and the crows take them.—(Thomas Allen, Thurmaston, Leicester.)

A field on my farm (on light soil, sea coast of Pembrokeshire), which has been under grass since 1878, was ploughed 2 ins. deep in the spring of this year. A second ploughing during April went to 4½ ins. deep. No manure was applied, and it was sown with Barley. The Wireworms soon appeared, more especially in the bores, when a heavy *Crosskill's ribbed roller* was used, first across the furrows, and afterwards along them. This had the desired effect, the Wireworm practically disappeared, and a good average crop of Barley followed. —(L. P. Williams, Penberry, St, David's.)

It is a general custom when crops of Barley or Oats are injured to use the *Cambridge roller* as soon as possible, which no doubt does good, as it kills some of the insects and helps to keep alive the plant which had been partially destroyed.—(Thos. Jones, Penpont Farm, Brecon.)

I have found that compressing the soil before sowing the crop, and during the early growth of the plant, has to a limited extent prevented the Worm from working. Hoeing the crop is also good; in short, any means of disturbing the Worms or hastening the growth of the plant, to enable it to get away from their attacks, is beneficial.—(Frederic Beard.)

Mustard.

Notes of the serviceableness of Mustard as a preventive for Wireworm; also instances of Wireworm not being observed as attacking various leguminous crops, as Clover, Peas, &c., if no grass was present, either as a part of the crop or as a weed amongst it.

It has been found by practical experience that the growing and ploughing in of White Mustard will get rid of Wireworm. The use of

Mustard as a growing manure crop is not sufficiently resorted to.—(Per Chas. Caswell, Peterborough.)

Mustard sown thickly and allowed to grow to a considerable length, and then ploughed in, has been found to be a good preventive, and at the same time adding considerably to the fertility of the land.—(Adam Lee, Lydbury North, Shropshire, for the Right Hon. the Earl of Powis.)

Found Mustard a good preventive, and sometimes the only safe crop to sow where Wireworm prevailed.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

I think Mustard acts as a preventive.—(Geo. Burgiss, The Farm, Struthergleu, Petworth.)

For fallow after cleaning sow Rape or Mustard Seed about the end of July, and plough it under when about a foot or eighteen inches high. (Contributed by J. Craig, Shifnal, Salop.)

The Wireworm has been known to disappear after a crop of White Mustard, of which one-half was eaten on the ground by sheep.—(Joseph Paget, Mansfield.)

I have no doubt of Mustard being a good remedy where it can be applied so as to be ploughed in for the crop.

I would suggest that Flax should be substituted for the Corn crop on all land most liable to the ravages of Wireworm, especially now that the fibre, harvested and threshed, can be utilized for paper-making, thus opening up a new and remunerative article of farm produce.

I have heard (and believe) it is invulnerable to the Wireworm, but cannot speak on the fact from my own experience.*—(T. R. Hulbert, North Cerney, Cirencester.

White Mustard sown and allowed to stand until it comes into flower is a very useful preparation—when ploughed in and pressed—for all corn, and, I think, prevents the Wireworm doing so much mischief.—(Joseph Addison, Mapledurwell, Basingstoke.)

I have never known Wireworm troublesome after Mustard or Vetches.—(M. Locke Blake, Ilminster.)

I have not found that Red Clover encourages Wireworm, but where mixed seeds and much Rye Grass are used I have found these very productive of Wireworm. The best remedy, and one frequently adopted, is to break up early and plant Mustard, which is an excellent preparation for Wheat, and I have found Mustard the best preventive of attack.—(H. Hayward, Hereford.)

I have not noticed Wheat after Clovers, Beans, or Peas affected, if no grass had grown among those crops. As for remedies, I can

* The only Beetles that I find reference to as injuring the Flax crops in their perfect or grub state are the Cockchafer and a kind of Flea Beetle.—Ed.

only suggest clean cultivation, sowing the *Clover Seeds* only for feeding or hay, if Wheat or Oats is to be taken as the next crop.—(Robert L. Pudney, Halstead, Essex.)

I have never known Peas attacked by Wireworm.—(T. H. Baker, Mere, Wilts.)

Presence after Certain Crops.

Presence of Wireworms after certain crops, such as Grass, Clover, &c.; also after crops which, by reason of the amount of stalks or stumps remaining from them in the ground, give thereby shelter to the Wireworms, or cause the soil to be open and unconsolidated.

My experience of Wireworm in excess was on land reclaimed by the spade from old turf, covered with furze, ferns, and such like, inhabited by birds of various kinds, devouring beetles, worms, &c. The land was sown to Oats, which were devoured by Wireworm, the wild birds having been scared by the continued presence of workmen. The roller, sheep-treading, and any means available to compress the land were used. The Turnip crop in succession was destroyed. Pressure was again applied, and the land left without a crop. In the spring and summer birds fed in great numbers on the land. A crop of Mustard was sown and fed off by sheep. Then Oats and Seeds for two years, and no more trouble with Wireworms.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

We generally get Wireworm in land which has lain down to grass two or three years, or after a crop of Sainfoin, which has been down some time. On the light land in this hill district (on the chalk formation) old leys are often broken up and sown with Oats, which rarely suffer from Wireworm, but the following year we generally find them, and in succeeding years they are often very troublesome.

In 1873 a piece of Sainfoin, which had been in existence for ten years, was broken up and sown to Oats, in which no Wireworm appeared. The next autumn Vetches were sown after the Oats, and produced a good crop. These were fed off in 1874 by sheep, and the land was sown to Rape. *This was entirely destroyed by Wireworms.* Then it was sown to Mustard, which was also eaten by them as soon as it came up, and is the only instance which has ever come under my observation of this crop being attacked by Wireworms. Then the land was sown to Wheat, and no Wireworm put in an appearance, neither have I seen any there since of any consequence.—(T. H. Baker, Mere, Wilts.)

Old turf is generally found (on being broken up) the *most* likely to be full of Wireworm, and requires the utmost care before being turned over, and very great watchfulness afterwards. Next to this "seeds" which have lain two or more years would be most likely to prove

troublesome; then those seeds which have only lain one season. Vetches and Peas are fouling crops, and give shelter to the Worm.—(Adam Lee, Lydbury North, Shropshire, for the Right Hon. the Earl of Powis.)

The cereal crops seem to be the most often affected by Wireworms. Wheat, for instance, if sown after "seeds" (containing grasses), is particularly liable to attack, and Wheat sown on weedy land, especially if the weeds be wild grasses, such as the long "water grass," often very common on wet land. I judge that the eggs are laid in the dead grass rubbish on the field, and that when the young crops are sown and growing (even from January during the spring of the year, if there be no frosts) the Wireworm pursues its way from plant to plant, half burying itself in the tender stalk, and then, after eating out its heart, leaving it for another.

Mangolds when young are often attacked and destroyed if sown after weedy white straw crops that have likewise suffered from the Wireworms.—(Robert L. Pudney, Halstead, Essex.)

Land is more subject to Wireworms after Clover and Beans, but there is no crop that increases Wireworm so much as "Couch" and weeds, and often when land has been fallowed the previous summer the Wireworms are quite as destructive in the next spring as they are on the Clover ley Wheat.—(G. Burgiss, The Farm, Struthergleu, Petworth.)

Certainly I think there is more danger from Wireworms after Clover than after any other crop. I believe after a crop of Beans or Cabbage they are also troublesome, but consider this may be because if a large amount of Bean-stalks or Cabbage-stumps are ploughed down the land would lie so open it could not be properly consolidated by rolling, and the Wireworm would have a chance to harbour and work in the stumps. After these crops, therefore, the land should be got as free as possible from stalks and stumps, as well as weeds, before ploughing.—(M. Locke Blake, Ilminster.)

I have observed that the Wireworms have appeared upon land immediately after a Turnip crop when not grazed by sheep or other animals. I have hitherto supposed that the appearance of the Wireworms after Turnips was due to the pulverized condition of the soil rather than to the nature of the preceding crop.—(L. P. Williams, Penberry, St. David's.)

Salt and Kainite.

Notes of heavy dressing with salt being found serviceable to kill Couch-grass, and also to destroy or drive away Wireworm. Lighter dressings found useful in promoting vigorous growth of Wheat. Salt also serviceable in garden cultivation to protect Cabbage from Wireworm attack. Observations of benefit from use of Kainite.

Salt at the rate of 5 or 6 cwt. per acre on light land is considered useful if sown before breaking Sainfoin or Clover ley.—(Joseph Addison, near Basingstoke.)

In former years I have experienced much benefit from the use of common salt, applied at the rate of 5 cwt. to the acre.—(L. P. Williams, Penberry, St. David's.)

An old ley was dressed with 10 cwt. of salt per acre in the autumn, and the salt ploughed in. This plan not only killed the Couch and Twitch, but on this piece of land there was no trouble from Wireworm, or from Grub, and none has been known to occur since.—(Per C. E. Curtis, Alton, Hants.)

I have known a heavy dressing of salt (10 or 12 cwt. per acre), applied some weeks previous to sowing, to have a good effect.

On the lighter lands of Radnorshire I have observed that Wireworm is most destructive on old and poor grass land ploughed up for Oats. The land being light, porous, and exhausted, offers every facility for the action of Wireworm. In such cases two or three crops are frequently destroyed in succession.

The general treatment is to *lime and salt liberally*, and to tread the land by consuming the root crops with sheep.

On the other hand, I have known strong loam, rich with farm-yard dung and artificial manure, but *without lime or salt*, suffer severely. I do not think that either salt or lime will directly kill Wireworm, but I venture to suggest that soil thoroughly impregnated with one or both may become an unfitting abode for it.—(David Rowland, Titley, Herefordshire.)

For six years previous to the year 1873 every crop in a 13-acre field belonging to me, and in my occupation, was more or less attacked by Wireworm. I farmed the field on the four-course system, and on two occasions four acres of Wheat in the middle of the field were destroyed by Wireworm. In 1873 the field was a Clover ley, and was dressed with 8 cwt. of salt to the acre previous to ploughing for Wheat, and 5 cwt. of damaged decorticated cotton cake per acre was also put on it at the time the Wheat was sown (the cake was best decorticated cotton cake, but had been a little damaged by fire, and cost £5 per ton delivered at my station). The crop of Wheat was very

good, and that portion where the Wireworm had previously done so much damage was the best. Every crop has since done well, and there has been no return of the pest.—(James Whitaker, Worthen, Shrewsbury.)

A piece of old turf on light soil broken up for Oats was then sowed with Turnips eaten off by lambs. This was next worked for Potatoes, and large quantities of Wireworms were observable. Two loads of common salt were procured and sowed broadcast, and it was not found that any of the Potatoes were eaten by the Wireworms.—(S. Massey, Church Lawton, Cheshire.)

I had two fields in Clover last year, both heavy crops, and each dug up in the autumn. One was sown with about 4 cwt. of salt per acre, the other left without any dressing. No Wireworm has appeared on either, but the salted field is more than double the crop in both thickness and vigour, though I should incline to say the other field was naturally rather the better, and both were treated to exactly the same quantity of manure last year. So we may say that the salt (even minus the effect on Wireworm) has had a valuable effect.

I see some few fields worked by Wireworms principally after Wheat, which was itself worked by Wireworm last year, and being a late cut crop (the worst field was not cut at all, and was shooting until the end of September, 1881) probably the eggs were laid in the crop of weeds at the bottom.—(George W. Latham, Sandbach, Cheshire.)

When I see Cabbage, or any of the *Brassica* tribe, showing signs of Wireworms being at the root, I put a ring of salt about three inches from the stem around each plant. This either kills or disperses the Wireworm, and the plant makes fresh roots and does well. In very dry weather the plants require watering with a rose after the application of the salt.—(Per J. Craig, Shifnal, Salop.)

Kainite.

In the year 1871 my attention was called to the damage done to a field of Wheat by the Wireworm, nearly one sixth of which was destroyed by them. I was induced to try the effect of Leopoldshall Kainite, and applied a dressing of about 3 cwt. per acre to the whole field, at the same time applying superphosphate and nitrate of soda. The Wireworms did no further damage.

Some two or three years after I noticed many Wireworms when my Potatoes were got up, and just before sowing with Wheat I applied 5 cwt. of Kainite to the Potato ground (one acre), none being applied to the other part, where Mangolds were growing. In the following spring the land which had received the Kainite was unhurt, whilst the other portion was thinned a good deal by the grub, and we had to

dress it also. I have frequently had to use the Kainite since, and I never knew it to fail if applied in time.—(T. S. T. Carrington, Uttoxeter.)

Regarding the attack of Wireworm there is never destruction to any great extent by it in this district (Blairgowrie). I have never had trouble from it to any extent, beyond small patches in a field. These I always dressed with nitrate of soda or Kainite salt, which I found to work well. The soil where I had to apply it was stiffish and mortar-like, where a proper mould could not easily be got. I applied the nitrate at the rate of about 2 cwt. per acre and the Kainite about 4 cwt., but I think more Kainite might be applied with advantage. Care must be taken to apply the salts when wet, otherwise there is a risk of burning the plants.—(T. H. Leslie, Blairgowrie, Perth.)

Gas-Lime and Alkali Waste.

Application of gas lime as a means of clearing ground of Wireworms, with some notes on use of alkali waste and gas-tar water.

For several years a portion of one of my fields was infested with Wireworms, and in spite of rape cake and other supposed remedies every successive crop was more or less injured, until one autumn I ploughed in refuse gas-lime, and from that time have never seen a Wireworm in that field.—(The Right Hon. the Earl of Essex, Cassiobury, Watford.)

Branxholme, Hawick.—I do not think we are much troubled here with Wireworm, except in very old pastures, and then our usual plan is ploughing up and dressing with gas-lime.—(W. Eliott Lockhart, Hawick, N.B.)

For Clover leys I should put about 10 cwt. of gas-lime to the acre, and then plough it under. I think this is a great preventive. If used for Turnips sow it on broadcast and work it in, and then add what may be thought best for the crop.—(S. Massey, Church Lawton, Cheshire.)

I dressed a few acres with gas-lime in March, and it seems to have freed the ground wonderfully.—(John Heatley, Passingham, Wolverhampton.)

Some years ago complaint was made of the destruction of grain crops on a limited portion of a field of rather light soil. I advised the trial of gas-lime, and several cart-loads were applied, with the result that not a trace of Wireworm was seen for several years after.—(Jos. Ellans, Anglesey.)

Alkali Waste.

This material, which much resembles gas-lime in its properties, is sometimes largely used in the neighbourhood of alkali works, and is

valuable on account of its intensely caustic nature, which destroys all life in weeds or insects alike which it may come in contact with before its nature is altered by exposure to the air. After this the "waste" is a safe and serviceable manure usually procurable at a very small cost, or merely at the remover's expense of carriage from the works. *

The following communication is with regard to the use of alkali waste produced in the manufacture of soda ash at Widnes, Lancashire:—

The Lancashire farmers get the waste for carting, and use it in heavy dressings to mellow heavy land, and destroy perennial weeds, as Couch-grass, Coltsfoot, or Thistles, but a dressing of two or three tons per statute acre is as much as grass land will bear at one time, and then it must be spread quickly, or the heaps will destroy the grass roots as well as the herbage.

This quantity per acre will be very fatal to the Wireworm, and is surprisingly penetrating. After much rain, drains three feet deep in a heavy soil yield milky white water after an application of two or three tons per acre.

On arable land five tons per acre is a good dressing, and fatal to all insect and worm life; deep-rooted perennial weeds require more, especially Coltsfoot.

This waste and gas-lime are somewhat similar in nature and action, but the waste is more caustic, and contains about two per cent. of soda, very valuable in agriculture. It loses the caustic nature when exposed to air and moisture, and the rule is to leave it on the surface of arable land, exposed to air and rain, for at least six weeks before ploughing it in. If it is buried in the soil before it has lost its caustic properties it destroys the seed, &c., when sown.

Care is requisite in carting it in wet weather, or any liquid drippings falling on the horse take off the hair, and make the skin raw and blistered.—(John Crompton, Rivington, Chorley.)

Many people in the neighbourhood of Widnes use the chemical waste for killing worms, and also for manure on strong land.—(Per S. Fitton, Nantwich.)

Gas Tar Water.

Four years ago I had a field of nine acres on light good gravelly soil in Wheat after Oats, and in February the plant commenced dying.

* For further particulars see "Alkali Waste," pp. 616, 617, 'Journal of Royal Agricultural Society,' vol. x., 1st series. From this it appears that alkali waste when fresh possesses caustic properties which are highly dangerous to vegetation, but after a time, by exposure to the air, the sulphur compounds become altered in their nature, and "essentially, then, alkali waste consists of sulphate and carbonate of lime, and may be used with advantage and economy wherever gypsum would be of use."

Rape dust, heavy rolling, and nitrate of soda, at the rate of 2 cwt. per acre, were successively tried, but little benefit appeared to result. I then, as we have gas made near, got a water-cart about half filled with the water off the gas-tar, and diluted it just weak enough not to kill the plant, and applied it by means of a watering-can, and found a most beneficial result.—(J. Prince, Foston, Derby.)

Rape Cake, Meal, &c.

Communications regarding the serviceableness of various kinds of Rape cake, nuts, or meal in diminishing amount of injury from Wireworm attack, whether by acting as a fertilizer or by attracting the Wireworm away from the crop. *

Found Rape cake of great service in stopping the ravages of Wireworms to growing crops, either because they preferred it to the plants (as could be seen by the presence of many eating their way into the lumps of cake), or, as some asserted, by poisoning them.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

* I have no doubt that the Rape cake I have used acted as a stimulus to the crop, the Barley being much heavier on the portion of the field dressed with Rape cake than on the other portion; but as the part on which the cake was sown was previously infested with Wireworm I believe it attracted the Wireworms from the plant. It may have killed them also, but of that I am not sure.—(George McQueen, Coed-y-Dinas, Welch Pool.)

* About the application of Rape dust to the land to destroy Wireworm, I may say that in 1874 I got two tons of very fine Rape dust (as fine as flour). I mixed it up with the Turnip manure, and sowed it in the drills in the usual manner. The result was very good. There was no Wireworm, and the crows did not look for any, but on about an acre of the field that got no Rape dust the Worm was bad and the crows pulled the Turnips. In 1875 I used three tons with the same good result. Of course it has a certain value as manure as well. —(Edward Gordon, Mains of Kelton, Kirkcudbright.)

Rape cake sown on the land has been found of much benefit.—(Adam Lee, Lydbury North, Shropshire.)

I have seen very good results from the application of artificial manure, particularly from Rape cake. The Wireworm is very fond of this food, and by leaving the crop in order to feed on the cake thus frees the plant from attack.—(Fred Beard, Horton, Canterbury.)

Rape cake of good quality is an excellent fertilizer for Wheat when sown at the same time, and Turnips do well as the following crop, but

* The entries to which an asterisk is prefixed refer to observations regarding Indian rape, *i.e.*, mustard cake.

I do not think that it would have more effect upon the Wireworm tha superphosphates or other applications of equal value as fertilizers.—(Ralph Lowe, Sleaford, Lincolnshire.)

* Barbersham Castle, Straffan, Ireland.—I took this farm twelve years ago; it had principally been a grazing farm. A year afterwards I ploughed up a field of sixteen acres of old ley, and sowed it with sixteen bushels of Oats. It brairded very well, but very soon it began to show signs of the Wireworm, and I scarcely got back the seed. After that I sowed fine ground Rape meal, mixed with the seeds, and have never had anything like the loss I had before doing so.

My mode of treatment has generally been to mix Oats and fine Rape meal together, put them in the hopper of Hornsby's Sowing Machine, and sow this once up and down and then across, so by that both corn and meal are nicely divided over the field, and from that I generally have a beautiful braird and very good crops.—(Charles Littleboy, Straffan, Leinster.)

About eight years ago I enclosed a piece of old pasture land, and converted it into a vegetable garden. The first year the Cabbages were destroyed, and large holes eaten in the Potatoes by Wireworm, and I dressed the garden thoroughly with lime, salt, and soot, but notwithstanding the vegetables were destroyed in the second year nearly as badly as before. I then covered the garden with Rape nuts, and have had no Wireworm since.—(R. Paver-Cron, Ornham Hall, Boroughbridge.)

The following experiments were tried in consequence of the belief often expressed that Wireworms feed so greedily on rape cake that they burst. This, however, I did not find to occur in any instance.

Through the courtesy of the manager of the Phœnix Oil Mills, Liverpool, and of Messrs. Ayre, Waterloo Mills, Hull, I was supplied well with the "Indian" Rape cake from the former, and with Black Sea Rape cake from the latter firm. These two kinds are both known to be serviceable for manure, but I found them somewhat different in their action on the Wireworms.

The Indian, or Kurrachee, cake is formed from Mustard seed. This I pounded into small lumps and dust, and mixed it with water. and then placed a good supply of healthy Wireworms on it with a little bit of turf. For about three days the smell of Mustard was very powerful, and the Wireworms would not leave their turf, and those that were placed on the Mustard cake, which presumably had still its stinging powers, appeared very uneasy. About the fourth day a putrescent smell succeeded that of Mustard, and the Wireworms began to go into the cake, where they fed (or, at least, I presume they fed, as there was nothing else for food) for about a fortnight. They seemed all well and thriving until the end of the fortnight, when I

found many dead or dying. I put fresh turf and broken potato and turnip, in addition to the cake, but all died.

The Wireworms which I placed on Black Sea Rape cake (that is, true Rape), broken and moistened as above mentioned, went into it at once and, like the others, fed (or appeared to feed, having no other supply); but whereas the Mustard-cake Wireworms died in about a fortnight, these were still alive at a period of three weeks or more after being put on the cake. I cannot tell how much longer they would have lived, for it was difficult to keep the cake in an evenly moist state, and by disturbance in examinations and possibly by attacks of birds the specimens lessened in number, but from August 2nd to August 22nd might be taken as a time during which they were thriving. *None* of the Wireworms which were experimented on burst from effects of eating, but it frequently occurred that when one was dead, or had so stiffened itself that it was cracked across in being moved, that consequently its white contents burst out where it was broken, and this may not improbably have given rise to the belief above referred to.—(Ed.)

Wireworm in Hop Land.

Wireworms frequently are most injurious to Hop plants, especially in fresh-planted grounds. These are the larvæ of the striped "Click Beetle," *Elater lineatus*, and they attack the "sets" or cuttings put in to form the Hop stocks directly they are planted. They bore into the juicy part of the stems of the sets, and suck out the sap and gnaw off the shoots as fast as they make their appearance. Old meadows and orchards are often converted into Hop grounds, and in these sometimes the mischief caused by Wireworm is very great, and unless expensive means are adopted to catch them two or three years elapse before a good plant can be obtained.

Planters do not like to pare and burn the turf with the humus, as it affords so much food to the plants if it is turned in and buried deeply, and all that can be done in these circumstances is to feed the sward off as closely as possible before it is ploughed in.

As Hop land is usually kept particularly free from weeds, and the Hop plants are set from 5½ feet to 6½ feet apart, the food for the Wireworm is not plentiful, and they therefore concentrate their attacks perforce upon the Hop plants.

The soil is often disturbed by the nidgetts between the plants, and by the spud around them, so that for the sake of peace and quietness they take refuge in the plant centres, and soon destroy the plants if they are not checked. If Hop plants show signs of weakness and decay they should be closely examined for Wireworm. Even in well-established Hop ground, that has been planted for a considerable time,

Wireworms do much harm, and weakness and slackness of bine, which is often produced by their attacks, is attributed to other causes, such as the unsuitableness of the subsoil, or the want of manure, or influences of climate.

When the presence of Wireworms is discovered in the plant centres they can only be got rid of by catching them; they are beyond the reach of caustic applications, and of the effects of rolling and nidgetting. In these circumstances traps should be laid for them in the shape of small pieces of rape-cake, mangel-wurzel, turnip, or carrot, placed close to each "hill" or plant centre, but the best of all these is the rape-cake. The Wireworms soon discover these tempting baits, and speedily bury themselves in them, and women are employed to look at them twice or three times a week, and take out the Wireworms snugly ensconced therein. As many as 200 Wireworms have been taken in this way from one plant centre in the course of three weeks or a month. It is a fallacy to imagine that rape-cake directly causes the death of the Wireworms by inducing them to gorge until they burst. Rape-cake acts, as has been shown above, as a capital trap by which they may be caught, and got rid of; or when it is applied broadcast to Hops or Corn by taking their attention from the plants which they had attacked before the rape was applied.

I saw a striking instance of this last spring in the case of a field of Oats taken after Wheat, in which the plants were looking thin, patchy, and sickly from the attack of Wireworm; 6 cwt. of rape-dust were put on per acre, which diverted the insects from the plants, and at the same time stimulated their flagging energies. The crop was the stoutest I ever saw, and yielded close upon eleven quarters per acre. If the straw had not gone down in places after the deluge of rain the yield would have been greater.

Rape-cake is very largely and generally used as a fertilizer for Hops, and there is no doubt Wireworms are encouraged to a certain extent by its extensive employment in Hop land, but it is certain that they will not prey upon the Hop plants so long as rape-cake is obtainable. I have tried to oust Wireworms from Hop plants by putting nitrate of soda, and lime, and soot close round the hills, but the results were not satisfactory. To prevent Wireworm attack the Hop land should be kept very clean, and the weeds and grass growing on the outsides and hedgerows carefully kept down.—(Charles Whitehead, Barming House, Maidstone.)

Handpicking.

Where Wireworms are unusually numerous upon Turnips there cannot be a more effective or cheaper method of dealing with them than that of picking them by hand.

A field of seventy acres between Sleaford and Lincoln, which was sown with common Turnips, and a full plant nearly ready for the hoe, was found to be infested with Wireworms of different ages. A number of girls were set to work, and taking each a drill row, and guided by the different colour or withered appearance of the plant, by a quick movement of the finger dislodged the "worms," and picking them up placed them in a small bottle carried in the left hand. These Wireworms were greedily eaten by the poultry.—(Ralph Lowe, Sleaford, Lincolnshire.)

I have seen the Wireworm caught in large numbers by placing sliced roots in Hop hills, women doing the work, and being paid by measure, a successful but expensive plan.—(Fred. Beard, Horton, Canterbury.)

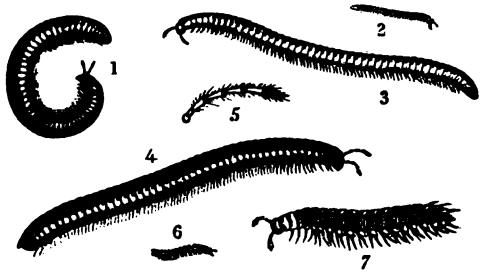
I have not been a sufferer from Wireworm ravage this year, but a neighbour has found them cause considerable damage among young Hops, so much so that he opened each hill, and inserted pieces of potato in every one. The next day the Wireworms had chosen the potatoes, and ten or a dozen were found boring into the pieces at each Hop root. At least two kinds were destroyed—the Wireworms, or larvæ of the Click Beetle, and the *Julus guttatus.* * This method proved effective, and saved his young plantations.—(D. Turvill, Alton, Hants.)

Application of Seaweed.

Orkney.—The island of Shapinsay is seven miles long and five miles broad, and is surrounded on the east by the German Ocean, on the

* The *Julus guttatus*, Fab. (*J. pulchellus Leach*) is one of the Snake Millipedes sometimes known as False Wireworms. These feed on vegetable matter, but how far they also feed as matter of regular diet on animal food, as worms, snails, &c., is not yet ascertained.

Polydesmus complanatus, Lin., the flattened Millipede, is another kind that sometimes does much damage to the roots of Wheat.



False Wireworms.

Snake Millipedes.—1, *Julus Londinensis;* 2 and 3, *J. guttatus*, nat. size and magnified; 4, *J. terrestris;* 5, horn; 6 and 7, flattened Millipede, *Polydesmus complanatus.*—'Farm Insects,' "Skip-Jack and the Wireworm," by A. M., &c.

north and west by the Atlantic. It is distant from Kirkwall four miles by sea.

Good crops are general when spring is warm and dry. The principal manure used for ley ground is *seaweed*, which probably accounts for the absence of Wireworm, which is quite unknown to the farmers in Orkney.—(Thos. McDonald, Kirkwall, Orkney.)

In regard to seaweed it is largely used all along the sea coast, where it can be procured. It gives good crops of all kinds, especially Turnips and Grass. Corn does well in dry seasons, but in wet it is liable to lodge, and the corn and straw is inferior. Seaweed is destructive to all kinds of insects, and I doubt not, to the Wireworms also.—(John Sutherland, Berridale, Caithness.)

Isle of Mull.—The Wireworm is sometimes troublesome in the gardens, but on the farm crops it does very little damage; in fact it is very seldom seen. The farmers and crofters use a great quantity of seaweed, which I have no doubt is the reason why there is so little Wireworm.—(C. Grierson, Isle of Mull.)

From inquiry made at some of the coast farms it appears they are never troubled by Wireworm. It is quite possible that the seaweed applied to the soil is a preventive.—(D. Husband, Struthers, Cupar, Fife.)

Bodorgan, Anglesey.—As far as my information and observation go Wireworm is not very troublesome in this district. Seaweed is used a good deal by some of the small farmers about here, principally for Potatoes in sandy soil.—(Joseph Ellans, Anglesey.)

Rooks, &c.

Rooks serviceable by clearing large numbers of Wireworms, but also frequently injurious by pulling up the plants (especially Turnips after being singled) in search of their food. (For further observations regarding Rooks see tables and abstract of Isle of Man Report.)—Notes as to usefulness of other birds, and also of Moles.

In the month of May I opened the crops of several "Crows," as we call them in Scotland (Rooks in England), and found them full of Wireworms. Earlier in the season I killed a Crow feeding on some damp grass land, and found about three dozen *Tipula* (Daddy long-legs) grubs in its crop. There is no doubt of the Crow, or Rook, being a valuable friend to the farmer in the spring months. Taking the seasons round, I am of the opinion, after long and careful observation, that the Rook does more good than harm to the farmer. No doubt if the birds are allowed to become too numerous, and insect food fails, they will fall on the crops rather heavily, but the cure is easy in that case, and in my experience of nearly a quarter of a century in

England, Scotland, and Ireland I have rarely seen it required.—(Malcolm Dunn, Dalkeith, N.B.)

Where Wireworms abound the Rooks, Plovers of different kinds, Partridges, and other birds feast, and are the best friends to the farmer.—(J. Forrester, for the Right Hon. Viscount Portman, Bryanston, Blandford.)

A good hoeing will help by disturbing the Wireworms and bringing them to the top, when Rooks will greedily search for them and devour them.—(Robert L. Pudney, Halstead, Essex.)

The remedies I know are the ploughing in of Mustard, deep winter ploughing, and repeated stirrings of the land, but the best remedy is the one that Nature has given us in the assistance of Rooks and Starlings. I strictly preserve birds, and now I have no Wireworm.—(C. R. Colville, Lullington, Burton-on-Trent.)

Many Wireworms will be found early in the morning, say about four o'clock, and Crows are most serviceable in picking up these larvæ, especially in the mornings, when they will be found working hard in infested fields.—(Robert Coupar, Scone, N.B.)

If we go to the fields at daybreak at the beginning of May we may observe the Rooks beating singly over every yard of ground, nothing appearing to escape their notice. These Rooks are providing for their young, and if the pouch of one of these birds is opened it will be found to contain a dozen sprouted barleycorns, a few dead dry earth worms, and upwards of thirty Click Beetles, soft and pulpy, which struggled up during the previous night from their chrysalids a few inches below ground. After six o'clock, the time when the horses go to work, a stream of Rooks may be seen coming and going, eagerly picking up Wireworms and Grubs in the furrows behind the light ploughs. Each Rook does not take fewer than fifty Wireworms during the day of eight hours, whilst the horses are at work, and later on (at the dusk hour) if the pouch of the latest Rook flying home be examined it will be found to be filled with Beetles, Caterpillars, and a little corn.*—(Ralph Lowe, Sleaford, Lincolnshire.)

Rooks Sometimes Destructive to the Crops.

Rooks will soon tell you where Wireworms are. I have often seen acres entirely cleared of good strong plants of roots by being pulled up by the Rook in search of his favourite food. Nothing requires greater attention on the farm than keeping Rooks off the roots when first singled out, where there is Wireworm among them, as the cure is often worse than the disease.—(T. R. Hulbert, North Cerney.)

* The observation as to the pouch of the Rook being filled with Beetles as it flies home "at the dusk hour" is particularly deserving of attention, as it is not generally known the Click Beetle may then be found in considerable numbers on the grass.—(Ed.)

The Wireworm does not do so much harm to the Turnips as the Crows do by pulling up the plants to get at the worm.—(R. Renton, Earlston, N.B.)

Two Pheasants were killed on the estate I manage, and in their crops were found 1500 Wireworms.—(Professor Charles E. Curtis, Farringdon, Hants.)

Owing, I think, to the large number of Moles, the Wireworm in this immediate neighbourhood (Longleat) is not much trouble.—(Wm. Taylor, Longleat Gardens, Warminster.)

Moles are very fond of Wireworms. You will always see them burrow most where the Worms are thickest. A neighbour of mine never kills any Moles, and has not done so for twelve years, and his crops are not so much destroyed as they used to be by Wireworms, but I think the cure almost, if not quite, as bad as the disease.—(D. Husband, Struthers, Cupar, Fife.)

Weybread, Suffolk.

Of the five communications with which I have been favoured, through the Rev. J. H. White, from the neighbourhood of Weybread, one makes mention of loss by Wireworm ravage amounting to a quarter of the crop; one mentions a quarter to half; and another notes the loss as usually a quarter, but sometimes half the crop.

The preventive measures advised are to plough soon enough, and keep the land solid, and to well bush and roll leys and pastures; also heavy rolling in spring to stop the Worm (as the looser the soil the worse the attack), and hand-hoeing and well rolling down the land are recommended. Artificial manure or nitrate of soda is recommended to run the crop on past the power of the Worm, and soot also is found useful, but no mention is made of the use of lime or of salt.

One observer notes that rolling and treading are very well on some soils, but when you have got the Worm you must humour it, and give it something to eat (? Rape-cake.—Ed.) until it changes its state or the crop beats it. "Seeds and certain grasses which harbour the Worm, and in which it delights to breed, of course increase the scourge."

"A certain amount" of Rooks are advised, and for Moles see below.

Having found that Wireworms were the favourite food of Moles, I determined (having first drained the land) not to destroy any more of the Moles, but to let them destroy the Wireworm, which having accomplished they speedily deserted my land.—(G. W. Pretty, Fressingfield, Harleston.)

Isle of Man.

Abstract, Observations, and Tables.

The following information regarding Wireworm and means used for its prevention in the Isle of Man has been kindly forwarded by residents in the island, in reply to forms arranged and circulated by Mr. Philip M. C. Kermode, to whom I am indebted both for his assistance in procuring these contributions and also for explanations and details which space does not allow insertion of in full.

For convenience of reference the greater part of the information reported is given in tabulated form, the name of the parish in which the observations were taken being prefixed in the first column with numbers to distinguish the different localities; but in deference to the implied wishes of the contributors their names are not given. In the following abstract the main points noted in the tables are given in connected form, together with a longer report and observations from Mr. McWhannel, of Glenduff, which could not conveniently be condensed:—

From these returns it appears that Wireworm attack often occurs to a serious amount in various localities in the island, but that the damage this year has been less than in previous ones. Three of the largest amounts of loss specified are about a quarter of the crop of Wheat, or two bolls to the acre; two bolls of Wheat and of Oats per acre; and about one boll per acre of Oats. The last mentioned is noted as about the same loss as last year, the two previous amounts of injury as less "than usual," or "in some previous years." *

Another observer notes loss of £1 10s. per acre last year in Wheat. Turnips have been injured up to loss of half the crop; of 1½ ton per acre; and in one case to a produce of only six, instead of fifteen tons, which was expected per acre. Carrots have suffered loss of half the crop in one locality, and in another were last year damaged at the rate of £10 per acre.

In some cases greater or less amount of attack corresponds with nature of soil. Taking four of the northern parishes of the island, we find no loss on the black soil at two localities noted in Kirk Andreas; injury at several places in Leyzayre on light soil, running to gravelly loam not on strong earthy soil; at Kirk Bride injury in this or preceding years to some extent on light soil. In Jurby attack

* In the Isle of Man a boll of Barley or of Oats is equal to six bushels, and a boll of Wheat to four bushels, weighing 64 lbs. to the bushel. The word "bruit" signifies the young plant when just appearing above ground, and until grown an inch or so in height.

occurs on gravel and sand, but less on light land, possibly from regular use of liquid manure, and looking at the returns as a whole they appear to show both absence or presence of Wireworm more or less on all kinds of soils.

For direct remedy the customary treatment of rolling is advised, together with applications which may make the ground unsuitable to the Wireworm, or may push on vigorous growth of the plant—as gas-lime, salt, soot, and also guano and liquid manure.

Seaweed is a good deal used in the island, and its application as a manure is noted at three places where slight attack of Wireworm occurred, but in reply to inquiries on this subject many contributors have entered "no seaweed used." I have not thought it necessary to note the non-application.

Lime also appears to be very seldom used, but—judging by the returns—to have a good effect when it is applied, and especially in one instance, where a liming a few years ago was followed in the present season by the application of kainite and superphosphate.

The observations regarding Rooks are well worth consideration, as showing that the good these birds do in clearing out Wireworm is by no means of an unmixed kind. There is no doubt, either in the Isle of Man or elsewhere, that Rooks clear Wireworm and other larvæ, but still where soil, state of crop, or want of food are such that the Rooks grub up and destroy the plants bodily it is matter for thought whether their numbers should not be lessened, or at least boys employed to frighten them off the crop during the few days after thinning, in which their work often does much more harm than good.

The following communication is also from the Isle of Man, but being at some length did not admit of tabulating:—

Glenduff, Lezayre.—No injury of any great importance has been caused by Wireworm this season. The crops most affected are those grown after green crops, and upon stubble; the previous crops to the injured ones were Summer Fallows, Potatoes, Turnips, and Wheat out of ley, but corn on ley, which was on heavy clay soil, has been almost free from injury, and uninjured crops followed sown seeds and young pasture.

The soil is fairly good, sharp, gravelly loam, intermingled by runs of white clay and peat. That which is most affected is light, open, sandy loam and dry peat.

The land was well dressed with farm-yard manure and bone superphosphate; very little lime, about one ton per acre in a five-course shift; no seaweed used.

Seed sown—of the injured crops generally in March and April, of the uninjured from November to Christmas. State of weather—wet in autumn and over dry in spring.

We are greatly troubled by Rooks and Larks, and they generally are the first to draw attention to the damage. It is impossible to detect the damage till some time after the Wireworm has been at work, then, though the young corn may appear healthy, the heart or central shoot will be found turning slightly yellow, and if pulled easily comes away.

Various measures of prevention are advocated, as hard rolling, gas-lime sown at the same time as the seed, or a top dressing of soot, salt, or superphosphate when the young corn is able to stand an after-rolling. All these methods will no doubt tend to counteract injury from the Wireworm by increasing the crop, but I do not think that they in any way destroy the Wireworm.

I am of opinion that when frost sets in the Wireworm goes down, and returns again when the weather changes. I have noticed when

ISLE OF MAN.

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Leyzayre .. I.	Oats and Wheat slightly injured. Previous crops, Grass and Turnips.	Wireworm most active on light soils.	Lime in a quick state laid on lea destroys the larvæ.	.. ..
II.	Some injury to Wheat and Oats. Previous crops, Grass and Green crops.	Gravelly loam.	.. ..	Spring sown crops suffered most. Ordinary weather.
III.	No injury	Turf and light and hilly soil. Loose soil more subject to attack.	Lime, farm-yard, and patent manure.	Wheat, end of Dec.; Oats, March; Barley, April; Green crops, May and June.
IV.	1. Oats after Green crop much injured; 2, Lea Oats not touched.	1. Light soil on hill. 2. Rather strong earthy soil on lowland.	1. Only patent and limed in lea. 2. Patent and farm-yard.	1. Latter end of March (pretty dry). 2. 5th of April.
Kirk Bride I.	No loss through attack.	Light soil ..	No difference in preparation between injured and uninjured.	Wheat in Nov., weather dry. Uninjured crop in Jan., weather dry.

trimming Turnips, say the evening before frost, that Wireworm could be noticed in hundreds about the roots of the Turnips. A frost sets in, and if you pull up the whole field you will not find a Wireworm where yesterday there were scores; but the weather changes, and our friend re-appears.

The injury from Wireworm has been less this year than almost any season I can recollect. I do not estimate my own loss, or that in the immediate neighbourhood or the parish, at more than half-a-bushel per acre.

The above remarks apply entirely to this district, as other localities may very likely be affected in an entirely different manner.—(James McWhannell.)

(The main points of the information with which I have been favoured by other contributors is embodied in the following tables.—Ed.)

Table I.

ervations ling Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	Remarks.
always nt crops sted by eworm.	.. ..	.. ..	.. ..	Injury from Wireworm has much increased of late years; partly from prejudice against rooks and wholesale poisoning of these birds; partly on account of farmers not having limed to any extent of late years, owing to agricultural depression and general want of means.
so much ibled by oks this r.	Rolling and sowing salt.	Observer's loss about 2 bolls per acre, not aware of loss in neighbourhood.	Less this year than usual.	
s a great t here, but not take nips till y are sin- l.	Salt and rolling would as a rule prevent attack if in time.	.. ..	Less	If Rooks are kept away for two or three days after the Turnips are singled out they will not touch the crop after.
numerous re the eworms e seen; not erved on low field.	Salt sometimes used. Consider it does not destroy the worm, but feeds the crop.	Observer's loss about a boll to the acre; not seen any crop spoiled in neighbourhood.	About the same as last year.	
on crop n 2 or 3 es high. ry about a th after.	Sowing salt and rolling for Wheat.	None this year. Previously severe in Wheat and Carrots.	Less. In previous year Wheat £1 10s. per acre. Carrots £10 per acre.	I consider Wheat sown in November as generally exempt from destruction by Wireworm.

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Kirk Bride II.	Turnips have suffered; previous crop Barley.	Loose and sandy.	We use seaweed and farm manure.	June .. ..
III.	Potatoes slightly after lea.	Light loam on sandy bottom.	Farm manure.	Planted in heavy rain in April.
Kirk Andreas I.	No loss. Barley after Potatoes, Turnips after lea.	Black soil ..	Yard manure.	Barley, May 18. Green crop about middle of June.
II.	No loss.	Black soil, loam	Farm and patent, or patent only. No difference seen in work of Wireworm.	Wheat, Dec.; Oats, April; Barley, May; Turnips, June.
Jurby .. I.	Carrots and Barley. Potatoes badly injured.	Sandy soil on gravel.	Farm-yard manure and dissolved bones. No lime.	Carrots and Potatoes planted about middle of April. Weather fine, soil moist.
II.	None at Thie Vane. Turnips after Oats on old lea at B'Managh badly attacked.	Sandy and gravelly; higher and most gravelly least attacked.	Dublin and Wicklow patent manure. Hollow with soil more earthy most attacked.	Injured crop end of May. Weather dry, but soil nice and moist.
III.	No injury	Light land on gravel.	Farm-yard and patent. No lime. Wireworm are worst in light, turfy soil.	Lea Wheat, Dec.; Barley, March; Oats, April; Green crops, beginning of June.
Ballaugh I.	Small amount of injury to Turnips only.	Black sand in the Curragh.	Lime, manure, and dissolved bones. Crops on dung unharmed.	Seed sown in May and June. Weather fine.
II.	About ¼ Wheat and ⅛ Turnips injured. Wheat after Green crops. Turnips after Oats.	Stiff loam, nearly marl.	Lime not been used for many years.	Wheat, 1st week in Jan.; Turnips, end of May, injured and uninjured same time; both in fine mild weather.
III.	No injury	Wireworm cuts worst in turfy soil. Wheat suffers most in this neighbourhood.	.. ..	.. ..

vations ıg Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	Remarks.
ch harm he Tur- but no in try- o get at ub.	.. ..	.. ..	Less. Suppose the season makes a difference.	The "cut worm" is more in heavier clay soils. The Rooks come when the Turnips are singled, because they can get at them.
never af- ay crops, h seen .	None tried ..	At one locality one-eighth crop of Oats.	Less	Most damage to Oats in May, to Potatoes during autumn. Magnum Bonum slightly attacked. "Skerries" on some land sound.
ch seen. a little by taking ɔes.	A little salt and rolling.	Do not know of any.	Less	There were frequent showers in spring to bring on and strengthen the plant.
on the ıis year.	None used, because Wireworm attack is never bad.	None noticed.	Less than in some years.	
see the where ireworm	None; been here only 3 years, and never had much attack before.	Not much. Half crop of Carrots lost.	More on this farm.	Did not have Wireworm for fifteen years at Ballis Maughold. Soil more loamy and stony on the hill.
warming he part the rorm efore we ɔd.	None tried. Never suffered to such an extent before	Turnips in the neighbourhood suffered a little.	More on my land.	At Thie Vane the soil is in part rather heavy, in part rather sandy and peaty. The Wireworms are not found there.
ın Wheat ɔping in they do by pull- up.	Liquid manure, Have tried this 8 or 10 years, and never found it fail to kill the Wireworm.	Crops not suffered on the whole.	Less than usual. When crops are earlier than usual worm does less harm.	Have found a good method to keep off Rooks to run a reel of cotton all round hedge of field, and across field just above corn.
re always ıe crops the worm hem.	Have tried salt, which I think the best remedy	.. ..	.. ..	
injured ps much before ter thin-	Have used gas-lime with advantage.	About 2 bolls (per acre) Wheat; 1½ ton Turnips. About same loss in some neighbouring farms.	Injury much less than in some former years.	Have observed Wireworm do less injury after a soft mild winter than after a hard frosty one.
ın Rooks up the after thinned ɔick out ɔrm.	Rolling Wheat early in spring is best. Have tried salt with little effect.	This neighbourbourhood has suffered very little.	.. ..	

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Ballaugh .. IV.	No injury	.. ..	.. ..	.. ..
V.*	Wheat crop out of lea suffered.	Soil inclining to gravelly.	Land limed the year before.	Wheat about the middle of December.
VI.	Turnips suffered slightly.	Sandy	Seaweed put under Potatoes (not for Turnips).	Turnips sown about end of May.
VII.	No injury	.. ..	Last year Turnip crop a comparative failure where patent manure only was used.	Wheat from beginning of Dec. Weather favourable.
Kirk Michael. I.	Very little, if any.	.. ..	.. ..	.. ..
II.	No money loss, but some Turnips pulled up by rooks (after Oats).	Light and sandy soil. No Turnips noticed pulled up on heavier land.	Patent bone-dust manure, no farm-yard manure, and on heavier land farm-yard manure.	Injured about 2nd week in June, uninjured about 25th May.
III.	Potatoes after Barley.	Light mould, blackish loam.	Extra crop of seaweed on it, and ploughed under farm manure heavy.	Planted about 5th of April in fine weather.
German ..	No injury	.. ..	.. ..	.. ..
Patrick .. I.	No injury	Soil dry	Land prepared in time with lime, seaweed, and farm manure.	.. ..
II.	Very little	Heavy soil ..	.. ..	.. ..
III.	Immaterial	.. ..	.. ..	.. ..

* Of a 7-acre field observed, of which 3 acres were treated with farm manure; a portion with patent and had the

ations ; Rooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
..	Soot and rolling the ground early in the morning when the dew is on.	Not aware of any loss this season.	.. ..	
ury by this .	.. ..	About $\frac{1}{8}$ of the portion of the crop affected.	Less than in former years.	Part of the field was dressed with seaweed for the green crop previous to the field becoming lea; that part was uninjured.
ure sure appear there reworm, ot much ere.	.. ..	Turnips slightly attacked.	Less. As good a season, free from cutting, as I think we ever had.	
id Jack- come onally. ittle, if arm.	Have found soot serviceable in garden cultivation.	Have not heard of loss in neighbourhood.	Very much less.	
always r on the bout the time as ireworm .	Sufficient rolling is, I think, the best remedy.	Some injury to Turnips, amount not known.	.. ..	The best remedy I know of and have tried is rolling; but the general impression here is that salt sown in with the seed or some time previous is very good.
on the within a ys after ng.	None	No money loss to observer, very trifling to neighbours.	Should say less.	No injury to corn has come under my notice.
Vheat is n bruit ome for ain, not ub.	None	Trifling	Not more than average.	"Skerries" the worst attacked. Potatoes sometimes destroyed in the spring, but most damaged in August.
ps have times d injury Rooks.	.. ..	We hardly ever suffer from Wireworm in this neighbourhood.	.. ..	This year the Rooks have destroyed most of our Potatoes, and many a year they have destroyed acres of our Turnips.
id much to Turp before means of ting them ..	.. ..	No damage of any consequence, excepting to Turnips by rooks.	.. ..	No injury to my Turnip crops by Wireworm within the last forty years.
	Salt	.. ..	Very much less.	
are the st pests. Turnips than an ave seen by them.	.. ..	Have about 150 acres under white crop, but scarcely the 8th of an acre spoiled.	.. ..	Rooks possibly often on the look out for Wireworm, but have not noticed the following crop the least affected, even on the spot most attacked by rooks.

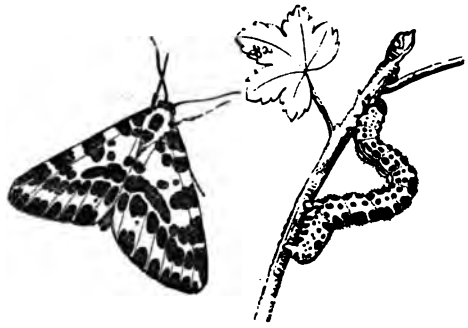
d about 2 acres with patent manure and dirty salt, this last portion was free from Wireworm and fly,

Parish of Observer.	Crop Injured and Nature of Crop preceding.	Nature of Soil.	Manure and Preparation of Land.	Date of Sowing and Weather at Time.
Santon ..	No injury this year.	Have found peat soil most liable to Wireworm.	Sowed this year with the drill, and did not do so formerly.	.. ..
Braddan .. I.	Slight to Oats sown in ley field.	Sandy	.. ..	17th March.
II.	No injury. Land previously pasture; Turnips and Potatoes.	Good brown earth. Subsoil shale or rotten stone. Light or shallow spots attacked first.	Mostly use town and farm manure mixed.	Oats 20th to end of March. Barley about the middle of April. Weather dry.
Onchan ..	Much less than usual.	Find Wireworm most troublesome on light land.	.. ..	In March. Weather dry.
Lonan ..	No injury this year.	.. ..	.. ..	.. ..
Maughold I.	Injury to Potatoes, Turnips, and Oats, about a quarter.	Light, stony, sharp, soil.	Farm-yard and patent for green crop.	Oats about 16th March. Green crops 8th and 10th May.
II.	Oats after Grass, and Swedes after Wheat, slightly injured.	Peat	Limed six years ago. Swedes manured with 3 cwt. superphosphate and 3 cwt. kainite.	Oats 18th March. Swedes first week in June.
III.	No injury to crops. Turnips after Oats, Barley after Potatoes, Oats on ley.	Partly loam, clay, and gravelly soil.	Barley well limed. Turnips on patent manure.	.. ..
IV	Turnips half crop; Potatoes bad; Barley rather bad; Oats slight attack.	Peat and clay. No difference as to amount of attack.	Well limed for Turnips and Potatoes. Patent manure as top dressing.	Injured and uninjured sown about same time. Weather wet.
V.	Very little. Turnips, previous crop Oats, which were very badly attacked.	Light soil. With us peat on the hills is clearest from the worm.	Both farm and patent and some seaweed in the field, which was not injured.	Uninjured in May, injured about the beginning of June.

ions tooks.	Remedies made use of.	Amount of Loss to Observer, or in his neighbourhood.	Injury more or less than in previous Years?	REMARKS.
.	Have found soot and gas-lime the best remedy	In the neighbourhood Wheat suffered sown on clay land which had lain in grass.	.. ..	
ı the , sow- .	No remedy tried.	Very slight injury in neighbourhood.	Less	.. ..
ı Rooks injury g Turget at ms.	Guano sowed on a wet day been found effectual in attack on light hill soil.	Oats after pasture crop chiefly injured in the neighbourhood.	Less	.. ..
n Oats sown ırnips nned.	Have tried gas-lime with very satisfactory results.	Turnips and Lea Oats suffered much.	Fewer complaints of Wireworm this year than usual.	.. ..
.	.. ..	No attack known of.	.. ..	.. ..
e been ıt kept 'ay all .	Have tried salt and tobacco by way of experiment, and found the latter kill the worm.	On B'corteen about half Turnips. I have about six tons Turnips where should be 15.	Less than last year, when Wireworm loss was half the crop.	There was a previous Green crop to half the Oats; the rest on land broken for the first time. The former was the worst attacked.
ɜerved ıbour- l just wedes ıned.	Do not know of any remedy.	Two acres of Swedes almost destroyed.	Injury rather greater this year.	I think that as farmers now leave their land longer in grass this may account for increased destruction by Wireworm. They have time to increase, and birds do not readily get at them.
.	Have tried salt and nitrate of soda, but not been successful.	Do not know of loss in this neighbourhood.	.. ..	
the when ıng.	Salt and soot with varying success.	About £25 to self.	Greater than usual.	
s are chiev- 'come r sin- d go ɜre the	Salt and rolling whilst crop is in bruit. Lime sown before ploughing.	.. ..	Very much less this year.	Believe the worms work most in dry weather. Have seen gas-lime used with good effect, not a Wireworm after it.

GOOSEBERRIES.

Magpie Moth. *Abraxas Grossulariata*, Steph.



ABRAXAS GROSSULARIATA.
Moth and Caterpillar.

Mr. W. Ward, writing from Stoke Edith Gardens, Herefordshire, mentions the caterpillar of the Gooseberry or Magpie Moth as one that is very troublesome in June and July, but that he has not had much attack after the dressings of hot lime and soot given to clear sawfly caterpillar from the bushes. (See Gooseberry Sawfly).

Mr. W. Taylor mentions the caterpillars of the Magpie Moth as being certainly not numerous in the neighbourhood of Longleat; and crossing from Wilts to Essex, Mr. Shipman mentions from West Ham that the Magpie Moths seen in 1880 were destroyed; little harm was done by the caterpillars in 1881, and in this year, 1882, not one was to be seen.

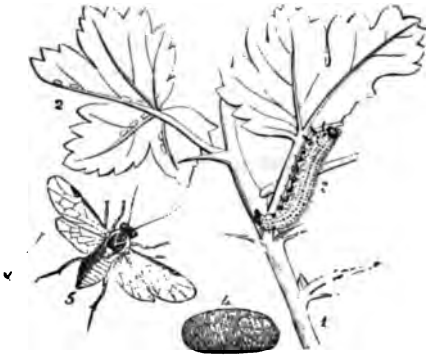
Gooseberry and Currant Sawfly. *Nematus ribesii*, Curtis.

The first two communications draw attention to the serviceableness of hellebore applied in a fluid state by means of a watering-pot, or as a spray, for destruction of the caterpillars.

Mr J. Busfeild, of Ripon, mentions having good success in clearing attack of the caterpillars from his Gooseberry bushes, by using a decoction of hellebore, so that it should fall as spray on the infested leaves. A large white-washing brush was dipped in the fluid and shaken nearly dry, and then so jerked against the branches as to send a good covering of spray well up beneath the leaves, which by this means were entirely cleared of the plague.

Mr. Geo. Brown, writing from Watten Mains, Caithness, says:—"Gooseberry Sawfly has been a source of annoyance to all gardeners in the north this season. Our bushes have literally been covered

with them, so that strong measures had to be resorted to. Quicklime was tried, but hellebore, although the more dangerous remedy, proved the most effectual; but we think it a mistake to dust the bushes, as it was noticed after the operation that a great number escaped, which would not have been the case if the hellebore had been infused in hot water, and applied to the bushes by means of the common watering-pot."



NEMATUS RIBESII.

Gooseberry Sawfly, caterpillar, and earth-cocoon.

Mr. James Kay, Rothesay, remarks that the Gooseberry Sawfly caterpillar appeared very slightly this year. He notes having given a watering of paraffin early in the spring, to the stems of the bushes and the ground beneath them.

Caterpillars are noticed by Mr. McDonald as unusually numerous at Balfour Castle Gardens, Orkney, N. B., upon Red and White Currants and Gooseberry bushes. Dusting with hellebore powder when the bushes are wet is noted as a speedy remedy.

Mr. W. Ward, writing from the Gardens, Stoke Edith, Hereford, mentions that in the spring of the present year (1882) he watched very closely for the first appearance of the Gooseberry Sawfly caterpillar, and found four trees suddenly attacked by this "pest." The four trees were immediately well syringed and shaken, the caterpillars dropping on to the soil, where they were treated with burning hot lime. All the other Gooseberry and Currant trees were dusted with hot lime and with soot, and there was no further trouble with caterpillars and a plentiful crop of Gooseberries and Currants. After the trees were cleared the soil was covered with the same materials—hot lime and soot.

Mr. Taylor adds a very useful hint as to a good way of mixing paraffin with water. He says—"The only safe method of applying this is with the syringe; when the paraffin and water are mixed,

discharge the syringe into the tub once,—then syringe once, and in this way he considers the application a safe insecticide.

Mr. Taylor, writing from Longleat, observes, that besides the common Gooseberry caterpillar, with which he is perfectly familiar, there is a smaller kind which appears a month or six weeks later. This lays its eggs, and the caterpillars also begin to feed at the edges of the leaves; commonly only about three are hatched on one leaf. Nevertheless, in some seasons they are as numerous as the common kind, which lays half a hundred or more on one leaf.

(The specimen of the small green Sawfly caterpillar forwarded corresponded with the description and figure of the rare kind, *Nematus consobrina*.—Ed.)

Mr. Taylor mentions that the chrysalis of this variety does not winter in the ground, unless it is just under the surface close to a wall or other dry place; it prefers the nail-holes in a wall or holes in wood, but it sometimes remains on the bush itself. Fir-tree oil, at the rate of half a pint to three gallons of soft water, applied in a fine spray all over the bushes, is the remedy used, but found to be an expensive one, as it has to be applied each time of appearance of the caterpillars, whilst they are yet small, and taking the two varieties together there are three or four broods during the summer. Shifting the bushes to new ground, some distance from their previous position, will give freedom from the caterpillars for a season.

The importance of bringing about a separation, in whatever way may be most practicable, between the Gooseberry bushes and infested ground cannot be too strongly impressed. Sometimes the Gooseberry bushes can be moved from the earth; but commonly it answers best to remove the surface earth from beneath the Gooseberry bushes. In either case the work should be thoroughly done, and a marked instance of failure from only half completing the work occurred in the past season, near Isleworth.

In the course of the autumn of 1881 the surface soil was duly removed from under the rows of bushes in a portion of a Gooseberry ground, but I observed that *it was not taken away*. The soil lay for months in rows between the rows of Gooseberry bushes, and in due time the attack, which was plainly to be expected, came, and the leafage was fairly devastated by caterpillar.

It is much to be wished that the superintendents on Gooseberry farms should themselves examine the state of the soil for two or three inches deep (or rather deeper in light soils), under a bush or two that has been attacked, and when they have found the brown caterpillar cases (which may be known by their likeness to the figure), and look like small brown earth pellets, just open a few and show the greenish caterpillar within to their workers. If the fact could by any means

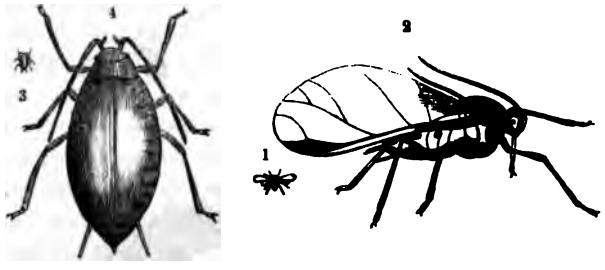
be impressed, that those caterpillars will live in their cases through the winter, and change to chrysalids and Sawflies in the spring, and, as surely as they are left under or by the bushes, the bushes will be infested again, it would be a great advance to getting rid of this loss which (in the complete face of knowledge of it being curable) is allowed yearly.

An observation was given me by a grower on a large scale, of these caterpillars having been seen in great numbers crossing a road which separated one ground from another. In cases of this sort, whether of Gooseberry caterpillar or other insects, which sometimes come on to the attack, plainly and visibly in large numbers crossing a definite space, the German plan of digging a ditch across their way might be made to answer as a method of prevention that would pay well.

If the ditch be filled with water to about half a foot below the ground level, and a boy set to see the creatures do not get out on the side they meant to travel to, this would do well; otherwise, shovelling on hot lime or gas lime, if at hand,—or if no other way occurred, setting a couple of boys to trample along the bottom of the ditch and destroy all that fell in,—would quite check the advance of the body.—Ed.

HOPS.

Hop Aphis. *Aphis humuli*, Schrank.; *Phorodon humuli*, Schrank.



1 & 2, Winged female Aphis; 3 & 4, larvæ or lice, nat. size and mag.

The attack of Aphis blight on the Hops during the past season has been the worst known for many years.

Mr. R. Cooke, writing from Detling, near Maidstone, mentions that the appearance of the blight was first talked about on the 16th of May, or a few days before, the attack beginning on the low river ground, from which it spread in all directions. On the 7th of June,

Mr. Hart noted from Kingsnorth, that great complaint was being made of the attack of Aphides on Hops, and on the 8th Mr. Whitehead mentioned, from Barming, that he had never seen the Aphis blight so prevalent; and observations were also made of the great quantities of Aphides on Apples, Plums, Damsons, Cherries, &c.

Mr. Turvill reported the appearance of the Fly near Alton, Hants, about the 20th of May, and by the 11th of June they were in masses on the Bines.

There was also in some places a scarcity of the natural check of the "Fly," namely, the Lady-birds and their grubs, known as "Niggers."* This was noticed specially in North Kent, where their scarcity, compared with other Hop districts, was remarkable; also by Prof. Fream, at the College of Agriculture, Downton, Wilts, on the 26th of June; and by Mr. A. Mannington, Northiam, Sussex, a few days previously.

As summer went on the published reports of the Hop districts in Kent, Sussex, Farnham, &c., showed for the most part the presence of "blight" in overwhelming quantities, together with the weak growth of the Bine from attack of the Aphis, and also from unfavourable weather. Want of sunshine, with low temperatures and sometimes cold nights, are reported again and again as accompanying

* The Lady-bird Beetle is well known everywhere, but its slaty or brownish six-legged grub, spotted with orange or scarlet, does not seem, from enquiries sent during the past season, to be as generally known as it ought to be; and as I have recently received a communication from Mr. Shipman, Forest Gate, mentioning that he found it was very often destroyed from want of knowledge of its useful habits in living on Aphides, or Green Fly, I add the following figures:—

LADY-BIRDS: 2, egg, mag.; 3 & 4, grub, mag., and line showing nat. size; 7, *Coccinella bipunctata*; 8, *C. dispar*; 9, *C. septem-punctata*.

These give a good idea of the grub, somewhat larger than life, and also of the chrysalis-case on the leaf; and these insects should *never* be destroyed, as the voracious appetite of the grub—and its strong jaws, by which it can nip hold of an Aphis, and shortly suck out its contents—makes this larva, as well as the Lady-bird, to which it presently turns, one of our best helpers, and often the only one we have in keeping down Aphis attack on Plums, Hops, Apples, &c.

the presence of hordes of the Blight; and these observations agree precisely with those of Mr. G. B. Buckton (our great authority on Aphides) as to the circumstances in which they multiply most rapidly. I give the passage, as it bears very practically on the method in which, where there is great amount of attack, the stinted pasturage causes the Fly to come to maturity sooner, consequently propagate sooner, and spread more quickly than even in its common rapid progress:—

"The addition of wings to the viviparous females obviously must much facilitate the spread of each species. This modification of form does not occur at fixed or stated intervals, but appears to be in some measure induced by an over-crowded state of the colony, and with a deficiency of food. Gardeners are well aware of the sickly and poisoned conditions produced in those plants which are subjected to the exhausting and irritating attacks of Aphides. When the nutritive juices of the infested plants begin to fail a change commences in the larvæ of those Aphides which are subsequently born. Swellings occur on the sides of the meso- and meta-thorax" [*i. e.*, the sides of the two ring-like divisions next but one to the head (Ed.)], "within which the future wings are developed," &c. Also, "I have repeatedly observed the effect of stinted food in hastening the development of wings."—'Brit. Aphides,' by G. B. Buckton, vol. i., pp. 72, 73.

When once bad attack is established there does not appear to be any sure way of getting it under, but we might get hold beforehand, if we knew *how and where the pest passes the winter*. It is not known whether the female Aphis of the last autumn brood lays eggs then, and dies, or whether she lives sheltered through the winter and lays in the spring. I have in the course of the past late autumn and early part of the winter searched microscopically for eggs or the female under dead Hop leaves, and also on pieces of the Bine and pieces of stem, just above and below ground-level, without the slightest success. In earth, taken from the neighbourhood of hills or plant-centres in ground where the attack was very virulent, sent by Mr. Whitehead from Barming, I found a very few bodies, that might be portions of skins of eggs, but even if they were so it was impossible to say that they were Aphis eggs.

The only *certain* way to make out whether the Aphides come up from the earth about the Hop-root appears to be some form of the plan by which Prof. Riley watched and discovered a portion of the method of increase of the *Phylloxera*, namely, to raise a light wooden frame over a plant, fasten some material such as very stout muslin over it, which would admit light to the Hop, but at the same time secure that no insects get in or out, have a piece of glass fitted at some part of the frame to allow of looking in, and then *watch*. The

frame need not be very large, for it is only wanted in the early stages of growth. In this way it would be possible to make out quite *surely* whether attack occurred, and if so whether it was from wingless females, which had lived through the winter and laid eggs in the spring, or whether it was from the so-called lice coming up from eggs which had been laid in the ground.

We might, however, learn much (if not all) we need during the coming season, if those who have the opportunity would watch the bines on a few hills as soon as they begin to shoot, giving a careful look every day (or even every two or three days), so as to be able to learn without doubt whether, when the *very first* Aphides appear, they are in the form of "lice" (that is, wingless) or of "fly" (that is, winged).

If they *appear as lice* it would seem impossible that they can have come from anywhere but some shelter in or near the hill where they have been hatched; if they *appear as fly* we cannot but suppose they have come on the wing from elsewhere; for the "fly" must have fed in its previous state as "louse," and if it had done this at the roots in the hill it would have been seen before this time.

If the attack does not begin from eggs or Aphides in the ground around the stool of the Hop, the next question is, *What part Plum trees or the Sloe bushes play in the matter?*

It is distinctly stated by three well-known German naturalists that the Hop Aphis, the *Aphis humuli*, is to be found on Plums or Sloes. One (Kaltenbach) states that he himself has found it on Sloe bushes in May; another (Taschenberg) that it is found on Sloe, and therefore Sloe bushes ought not to be left near Hop grounds; and a third (Koch) states that *this Aphis* is to be found in May in great numbers on the young shoots and beneath the leaves of the Plum and Sloe, and that in the month of June these Aphides (that is the *A. humuli*) leave the Plum leaves and betake themselves to the Hop. This view was also taken by one of our own naturalists, Francis Walker, and it well deserves proving or disproving, for the notes given from our own Hop grounds of Hop Aphis being first observed *in the winged state* make it appear very likely that the creatures may have flown from some neighbouring feeding ground.

It is observed by Mr. Hart, of Kingsnorth, "It is generally considered that the Aphis first appears on the Hop in the winged form. The 'lice,' as they are termed, are never seen till after the 'fly' has appeared."

Mr. Whitehead also informs me that they are supposed always to appear first as *Flies*, but that he saw wingless Aphides in April last on the Hop plant, before the others were seen.

Mr. Turvill, also, writing from near Alton, mentions the appearance of "Mature Fly" about the 20th of May, and deposit following.

These points—namely, where they spend the winter, or whether they migrate—are what we need to *know*, in order to be able to forestall attack, and what can only be made out by watching the Hops.

Aphis attack has now been going on as a most serious trouble for more than ninety years, and will so continue until we gain more knowledge, but a little careful observation by many growers would most likely give all we need to teach us how to reach the enemy when at our mercy in winter quarters. I should gladly receive any notes that I may be favoured with on the subject, to be formed into a paper for publication, and I would with the greatest pleasure identify whether specimens sent were Hop Aphis, or give every information in my power.

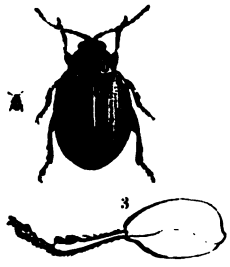
Hop Flea Beetle, *Psylliodes attenuatus*; and Hop Cone or Strig Maggot.

On April 22nd I received from Mr. T. H. Hart, Kingsnorth, Kent, specimens of the above-named Beetle, with the observation that this kind may be considered as "the" Hop Flea Beetle of the district, the damage caused by "tooth-legged" or "brassy" Flea Beetle being small in comparison. The observer notes that nine-tenths of many hundreds taken in Hop gardens have proved to be this species, but that at a distance from such gardens he has seldom found it.

The two kinds of Beetles are very much alike, both of them being brassy or bronze-green above, and about the size and shape of the common Turnip Flea Beetles, but under a magnifying-glass the *P. attenuatus* may be distinguished by the shank of the hind pair of legs having the foot inserted *a little way up* it (instead of at the lowest end), whilst the "tooth-legged" Flea Beetle has a tooth on the outer side of the shank of both of its two hinder pairs of legs (see fig.).

Where the *Psylliodes* propagate is not known, neither is it known what the little white maggot, which sometimes does a deal of harm by burrowing along the strig of the Hop cone, turns into; but if we can get a few observations, made about the beginning of September next, this point may be made out, and I conjecture we shall find the white

maggot to be the early stage of the *P. attenuatus*, which in such case we might perhaps more conveniently call the Hop Cone or Strig Beetle.



1 and 2, Tooth-legged Flea Beetle, *Chætocnema concinna*, nat. size and magnified; 3, hind leg, magnified.

With regard to the habits of this maggot, Mr. Goodwin, writing from Cranch, Sevenoaks, mentions that attack from it has been very general in that neighbourhood, where the attack has ruined several pieces of Hops. He observes that it pierces into or rather is bred in the "strig" or stalk of the cone or flower, where it eats its way up the inside of the stalk, which causes the Hops to wither and turn brown. The maggots varied in number in one strig, but one or two were the average. In the earlier part of September these maggots were very numerous, but at the date of writing, September 27th, they had disappeared—"they drop out into the earth after eating the Hops."

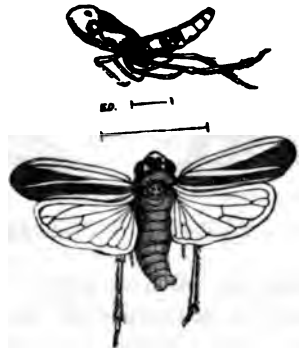
Specimens forwarded to me by Mr. Goodwin and from other localities, all showed the burrows of the maggots very plainly, but in all cases the maggot was absent, which confirms the observation of Mr. Goodwin and the conjectures of other observers, as to this grub leaving the Hop to change to the chrysalis and beetle in the earth.

Mr. R. Cooke forwarded specimens of Hops similarly attacked, from Detling, near Maidstone, mentioning that the altered colour was from the attack of a maggot, which channelled out a home for itself in the stem which forms the centre of the cone. The attacked Hops begin to go off from the tips, and the stem which supports the Hop dies back to the main branch. If in the next season some of the infested Hops were placed on earth in a flower-pot or box (tied over with a piece of stout muslin to prevent any escape), whatever beetle this maggot turned into might be secured when it came up from the earth and identified.

In the case of the maggots of *Psylliodes chrysocephalus* (a nearly allied beetle), which I have observed tunnelling the flowering stems

of Turnips early in the year, these maggots only went down just below the surface and went through their changes, and reappeared as beetles in about a month.

Frog Fly; Cuckoo Fly; Jumper. *Euacanthus interruptus*, Linn.



EUACANTHUS INTERRUPTUS.

Cuckoo Fly, winged and in early stage, magnified; lines showing nat. size.

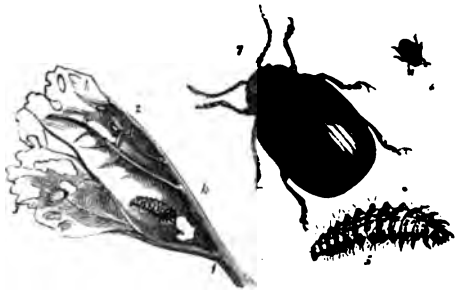
The only notes I have received throwing any light on the point of where the Cuckoo Flies, known also as Frog Flies or Jumpers, come out from to infest the Hop, are from Mr. D. Turvill, West Worldham, Alton, one of the neighbourhoods where these "jumpers" were particularly injurious in 1881.

Writing on the 11th of June he mentions—"I discovered the young 'Cuckoos' first this year in the base of the plants close to the ground, amongst what is known as the 'clearings,' or the superfluous vines that are neglected by the 'tyers,' and allowed to trail in a bunch around the roots of the plant—their appearing there first gives the idea of their emerging from the ground." Mr. Turvill mentions the Jumpers were not so prevalent as last season.

At Detling, near Maidstone, it is also noted that there was scarcely any attack this year.

MUSTARD.

Mustard Beetle. *Phædon betulæ*, Linn.; *P. Cochleariæ*, Fab.*



MUSTARD BEETLE, nat. size and mag. †

On June 6th I received the following note from Mr. C. Caswell, of Peterborough, regarding the Mustard Seed Beetle, with specimens accompanying:—Are you aware of the existence of a great pest in the shape of a beetle called by the farmer the Black Jack, that infests the Fen district between Peterborough and Ely, especially round Whittlesea? They feed upon White and Brown Mustard plants, Cress, Rape, or Cole, and are so destructive that in six or seven days they will completely destroy a field of twelve acres, and leave nothing but the bare stalks.

For the last two or three years the farmers have been afraid to sow White Mustard, of which the insect makes first choice. This was a most profitable crop, and hundreds of acres used to be grown in this district. The insect will live through the most severe winter in the pipe of the reeds and rushes in ditches and drains. Two or three years since they were so numerous that many acres of nearly ripe seed were burnt in the fields to destroy the beetle, but this was not effective, as they drop before the flame and bury themselves in the soil.

We have found the beetles alive in sacks of the seed for two years after it has been threshed.

Mr. William C. Little, of Stag's Holt, near March, mentions that for some years past immense damage has been done by the Mustard

* This beetle is sometimes injurious to Horse Radish, *Cochlearia Armoracia*, Linn.

† The beetle figured above, nat. size and magnified, is the *Phædon (Chrysomela) Betulæ*, commonly known as the Mustard Beetle, and the larvæ are of some species of *Chrysomela*, considered by John Curtis to be probably, but not quite certainly, those of *Betulæ*. As I have not had any opportunity as yet of figuring the grubs myself, I give the good representation of John Curtis of the beetle with his further observation.

Beetle to crops of White and Brown Mustard, which are largely grown for seed in the district. On some farms the cultivation of these crops has been given up (at least for a time) because they were so infested with this plague. The chief damage is done either by the grubs, "the Black Jacks," or by the brood which is in full vigour in July. They seem at this season to eat out all the succulent part of the plant, and to leave only the woody fibre, and they so completely destroy the shell (cosh) of the seed-pod that the seed is shed and falls to the ground.

From a Mustard field they troop off to any neighbouring field where plants of the same tribe are to be found. They will completely devour a field of Rape if it is in a young stage, and a crop of Kohl Rabi, with bulbs as big as an orange, may sometimes be seen with the leaves eaten off by these insects, nothing but the rib of the leaf being left. At this period they seem to make little use of their wings. I have stopped their progress completely by burning damp straw in a gateway through which they were passing, but previously they fly vigorously. No attempts appear to be made to check the pest, excepting the above plan of occasionally burning straw or stubble to arrest their progress when moving from one crop to another, or burning the straw or haulm after the crop has been reaped, by which means the great numbers of beetles which had sheltered in the hollow stems of the plant are destroyed.

Mr. Little mentions that the Brown Mustard crop is not often seriously injured by this insect, as it ripens a little too early for the young brood, but the White Mustard, which is always a little later, is often completely destroyed. The best preventive of the ruin of the crop is considered to be sowing as early as is safe to secure good germination (and that the young plant shall not suffer from frost), and liberal manuring. The vigorous plant can thrive under an attack which would destroy a weakly one, and an early ripening diminishes the risk.

It appears from the notes of various observers that the Mustard Beetles live through the winter, and shelter themselves in different kinds of places, sometimes amongst the roots of grass, often in hollow stems of Mustard * or the pipes of reeds, and it appears likely that, just in the same way with the Turnip Flea Beetle, to which they are

* Mr. Little mentions—"Some years ago nearly all the Mustard straw was burnt when the crop was threshed, which was generally in the autumn, but now a good deal is saved to make rough sheltering walls for cattle, and the cottagers beg a few loads, and make use of it for covering their sheds or hovels." Looking at the fact of the beetles being known to shelter in Mustard straw in the winter, it appears well worth while to make out accurately whether they harbour in sufficient quantity in the old straw to make the loss on burning this less than what would be caused by the broods the wintered Beetles would start in the next spring.

nearly allied, they would be found during winter under anything that would protect them.

In the spring (it is stated by Kaltenbach) the beetle is to be found in damp places on brook lime and on the bitter cress, *Cardamine amara*, and the grubs are to be found feeding on the underside of the brook lime leaves. When full fed the grubs leave the plant and turn to chrysalids in the earth, but without spinning any kind of shelter for themselves, and the chrysalis state lasts only fourteen days. The beetles, of which a figure is given above, are of a bright blue or green, with the underside, horns, and feet black. Two broods of caterpillars have been observed, the first in May and June, the second in September.*

The only method at present found of real service in keeping down the multiplication of these beetles appears to be a change of crop, which may remove their chief food, but removal of the Mustard straw, and burning it instead of allowing it to be stored for shelters or rough roofing, is recommended, and burning all standing rubbish round fields as well.

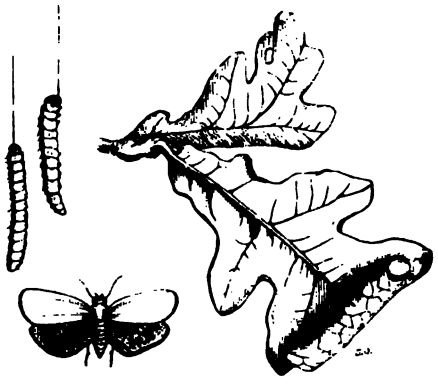
The methods of prevention noted will be observed to turn on the same principles as those brought forward in 1881 regarding prevention of Turnip Fly—namely, to clear out the pest by removing its food; to run the crop through moderate attack by vigorous growth; and also as far as possible to get it on so as to be at a different time to when the first burst of attack may be expected in full force.

No mention is made of any dressings such as are considered by many Turnip growers to be serviceable in checking attack having been tried whilst the Mustard is still young enough to allow of the application; nor of whether any caustic dressing, such as fresh gas-lime, is used to destroy the beetles that might be above or near the surface after a Mustard crop; nor yet of whether any clearing of the plants in or by the ditches, which afford shelter in winter and food in spring, as hollow reeds, water-cress, brook lime, bitter cress, shepherd's purse, &c., has ever been found practicable on a scale to be of service to the crops close by. Any information on these heads would be very acceptable for publication.

* See 'Die Pflanzen-feinde,' by J. H. Kaltenbach, p. 26.

OAK.

Leaf Roller Moth. *Tortrix viridana*, Stephens.



Moth; caterpillars hanging from their threads; and rolled leaf.

The Oak Leaf Roller Caterpillars are noticed by Mr. Robert Coupar as having caused much damage to the Oak foliage at Colenden, Perthshire, the attack being most severe to trees that either stood alone or on the outside of plantations, or by the side of drives. *

ONIONS.

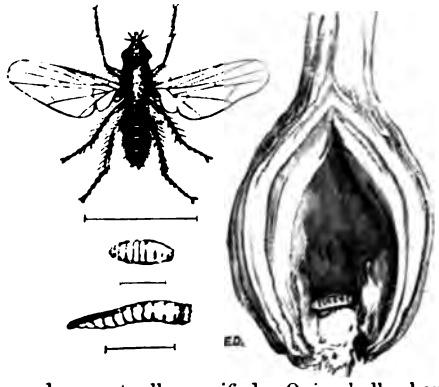
Onion Fly. *Anthomyia ceparum*, Curtis; *A. antiqua*, Meig.
Leek or Shallot Fly. *Anthomyia platura*, Meigen.

The injury to Onion crops in this country has commonly been supposed to be caused by only one kind of fly; but in the course of 1882, specimens of Maggots infesting Onions in different parts of the country having been submitted to Mr. R. H. Meade, of Bradford, he reared from these another species of Onion Fly, the *Anthomyia platura* of Meigen, sometimes known on the Continent as the Shallot Fly, besides the well-known *A. ceparum*, or, as it appears now more generally called scientifically, the *A. antiqua*.

These small two-winged blackish and grey flies are much alike in appearance, but for practical purposes it may turn out of great service to know there are two sorts, as they do not seem to be quite alike in their habits.

* Leaf Rollers were also injurious to the Sycamores, or Planes, as they are sometimes called in North Britain.

With regard to egg-laying, the *A. ceparum* (supposed to be specially *the* Onion Fly) has been stated by various writers to lay its eggs on the leafage, from which eggs the maggots eat their way down into the bulb; but from observations made in my own garden I found attack



Onion Fly, pupa, and maggot, all magnified. Onion bulb, showing pupa remaining in stored Onion.

was generally begun, not in this way, but from eggs laid either quite at the base of the bulb or at the lower part of the side. I submitted specimens of the Maggots infesting these Onions to Mr. Meade, and they proved to be not of *A. ceparum*, but of *A. platura* (more conveniently called the Shallot Fly).

This difference in habit of the two kinds, if constant, is an important consideration in methods of dealing with the attack. In my own garden I had the bulbs of the Onions kept carefully covered with earth during their early growth, and they did not suffer from Maggot until about the 3rd of July, when some slight injury appeared, and I had the rows well earthed up by means of the hoe, and found this answer well; only a few of the Onions were destroyed, and though many were afterwards attacked the strength of the plant caused them to overgrow the injury, and I had little loss.

Earlier in the year Mr. Malcolm Dunn forwarded specimens of Maggots, then attacking the Onions at Dalkeith, to Mr. Meade (whilst still young and as yet with hardly any bulb formed), and these were in due course found by Mr. Meade to be of both the *Anthomyia antiqua* and also of *Anthomyia platura*.

With regard to the method of attack Mr. Dunn says—"I have examined a good many specimens of Onions, and could discover neither eggs nor young grubs *above* the surface of the ground; but *immediately below* the surface the grubs are busily at work." Mr. Dunn also states that he is satisfied that these flies are attracted by putrid or decaying vegetable matter, and this point is a very important one. In the case

of the Shallot Fly Bouché found its Maggots by thousands in night soil, and we need to know more clearly whether by applying manure that attracts the Fly we increase attack of Maggots to the bulb, or whether, on the other hand, such applications may serve as a decoy to draw off the maggots.

In the course of last season I applied a thick dressing of what is known as "Indian" Rape-cake (that is, Mustard-cake), which smells almost intolerably whilst putrefying, and is in this stage very attractive to flies, and soon found it infested with Maggots, whilst the Onions did well.

The very different amount of attack to Onions and to Leeks is also worth considering. Some kinds of Onion Fly feed indifferently on either plant, and there does not appear to be any reason why the Leeks should not suffer as much as the Onions, excepting the difference in method of cultivation by which in earthing up the Leeks we protect the bulbs by a good solid coating of earth from the flies getting at them to lay their eggs. Two years' trial of the effect of earthing up Onions have made me think that this plan would save much loss wherever the Onions are sowed in drills, so as to admit of earthing by the hoe; where they are sown broadcast of course the plan is not practicable.

With regard to remedies for attack Mr. W. Taylor, Longleat, Warminster, mentions that last spring some of the Onions showed signs of flagging whilst still only about the diameter of a knitting-needle. Every Onion so affected was pulled up, carefully placed in a basket, and *carried straight to the stoke-hole fire*. The plants were treated in this manner every two or three days for three weeks, and the result was that there was no further damage during the summer, and the crop of Onions was the only good one in the neighbourhood.

Mr. Taylor notes that one of his garden men followed the plan so far as to pull up all the faulty Onions in his garden, but he threw them down *a short distance from the bed, and lost his entire crop.*

Mr. W. Ward, writing from The Gardens, Stoke Edith Park, Hereford, mentions that he has found quicklime and salt at the same rate of quantities to be of great service in keeping the "pests" away from Onions,—these used in the same way as pointed out for Carrots, see p. 12.

Mr. Malcolm Dunn, of Dalkeith, mentions that when he saw the first signs of attack on Onions he had them dressed with dry soot and lime, taking care that it was applied *close around the stems* of the plants. Two or three careful applications put an end to the attacks, and the crops scarcely suffered.

Mr. Grierson notices that on the first appearance of the Onion Fly on his crop at Torloisk, Isle of Mull, he had all the attacked Onions

carefully pulled up and *burnt*, and gave the break a good watering with paraffin oil and water, and repeated the pulling up and watering whenever the Maggot made its appearance, and saved a good crop.

PARSNIP.

Parsnip Seed Moth. *Depressaria Heracleana*, De Geer.

On the 21st of July I received from Mr. W. W. Glenny, of Barking, some heads of Parsnip Seed, webbed up by some small Moth Caterpillars then within them. These Caterpillars were from half to three-quarters of an inch long, of a greenish grey colour, dotted with small black warts above and orange colour below, and the heads black. Not being acquainted with the species, I submitted it to Professor Westwood, who reared the moth, and kindly informs me that it is the *Depressaria Heracleana*.

This is a small moth about an inch across in the spread of the fore wings, which are of a pale drab or greyish colour, marked with darker or black dashes, and the hind wings are pale gray.

The observations of various writers show that this moth very much resembles some of the other kinds of *Depressaria*, commonly known as

PARSNIP SEED MOTH. *Depressaria cicutella.*
Common Flat-body Moth, caterpillar and chrysalis; lines showing nat. size.

Carrot or Parsnip Seed Moths, both in appearance and in habits in the caterpillar state, but from it being more commonly found in this stage feeding on the flowers and unripe seeds of the common Hog-

weed, *Heraclium Sphondylium*, than those of the Parsnip, the special name of *Heracleana* has been given to it.

It appears from various writers that the *Depressaria* larvæ are to be found in June and July, and when full fed leave the heads, and either change to chrysalids on the ground or bore into the stem of the plant and change within. The Moth appears during August and September, and the attack is considered to be started in the following spring from eggs laid by females which have lived through the winter.

This kind is mentioned by Kaltenbach as attacking Parsnips in Germany, but is not alluded to among the kinds specially named as injurious by John Curtis.

Mr. Glenny, when writing on the subject of prevention, observed—"The caterpillar on the Parsnip Seed is very easily disposed of, for if the heads of the plant are carefully separated, and the woven web destroyed by hand, the insect falls to the ground, and as the plant is at that stage of its growth about five feet in height the caterpillar cannot reach the summit again to do any mischief even if it wished.

As Parsnip Seed is generally grown in small areas, it is easier to deal with the caterpillar in this way than if large fields were taken up with its cultivation."

In attacks of some of the other kinds of Parsnip Seed or Blossom Moth it has been advised just to shake the head; the caterpillar lets itself down by a thread on alarm, and if the work is thoroughly done, so that it cannot go back up the thread, or is kept, either by instinct, or by being trampled on, from going back up the stem, the method would answer well.

Many kinds of these "Flat-body Moths," or *Depressaria*, feed in the caterpillar state in the heads of wild umbelliferous plants, such as chervil, cowbane, or water hemlock, hogweed, &c., and it would be likely to lessen amount of attack to the cultivated umbelliferous plants, namely, Carrots and Parsnips, if these great weeds, some of which are found in large patches, were destroyed.

For full account of the *D. Heracleana* see the paper on "Parsnip Seed Moth," with an excellent and full illustration by Professor J. O. Westwood, in the 'Gardener's Chronicle' for Nov. 18th, 1882, p. 652.

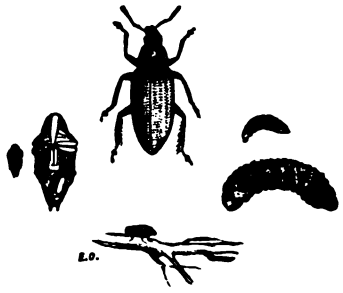
PEAS.

Pea Weevil, *Sitona lineata*, Linn.

The accompanying figure shows the Pea Weevil, *Sitona lineata*, in its three stages of maggot, chrysalis, and beetle, life size and magnified, drawn from specimens forwarded to me by Mr. T. H. Hart, of

Park Farm, Kingsnorth, Kent, together with information from observations taken by himself of the habits and history of this Weevil, which have so long been sought for previously without success.

Mr. Hart mentions that his attention having been directed to a Weevil grub having been found feeding on Clover roots, that he pro-



Pea Weevil, maggot and chrysalis, all nat. size and magnified.

ceeded to examine his Pea roots (not as before by loosening the soil and drawing the plant out of the ground, but by digging up the plant bodily, and carefully removing the earth), and soon found many Weevil grubs. This was on the 31st of May. Some of these grubs, or maggots, were lying along the main root, which bore marks of channels having been eaten along it, but, for the most part, the soft gall-like growths so often to be found on the fibres of Pea roots appeared to be their favourite food; some of the maggots were found within the galls, but only where there was such an opening as to give evident means for the passage of the grub to the inside. The maggots when full grown were of the size and shape figured above, white, plump, and wrinkled, with a brownish horny head, and pair of strong projecting jaws, legless, but using the end of the tail as a kind of foot to help them in progression. When full fed the maggot formed an oval cell (without a lining) in the earth about two inches below the surface, in which it changed immediately to the chrysalis state. In this stage it is like the perfect Weevil, only with the limbs folded beneath it—at first it is white, but as it matures the eyes become black and the proboscis pitchy. The Weevil when fully developed is black, and grey above, with three light stripes from the head to the wing-cases, and the wing-cases are marked with narrow stripes running along them of alternately lighter and darker tint. The Weevils from the maggots brought in from the field reached the perfect state by the 6th of July; those left in their natural position in the field did not develop until somewhat later.

All that we need now to complete the life-history of this Weevil

is the knowledge of when and where the eggs are laid; but as the Weevils have been observed when in confinement pairing and laying eggs rather earlier in the season than the time when the maggots were found feeding on the roots by Mr. Hart, it is presumable that when at large the females go down into the ground to deposit their eggs amongst these roots.

In the maggot state they do not, as far as we see, cause nearly so much harm to the roots as the Weevil does afterwards (when it is developed) to the leafage of the Peas. Then—though the damage is only too plain—the Weevils are not often noticeable unless the plants are approached exceedingly gently, for at the least alarm they drop down and hide themselves.

It is observed by Mr. Hart that if the soil in which the Pea Weevils are hidden is pressed firmly down with the foot for the space of some half-yard square that in a few seconds the place will appear alive with the Weevils, which will push their way to the surface. If, therefore, the weather admits of the free and repeated use of the roller a great proportion of the beetles may be crushed or rolled down so as to prevent them coming to the surface, and the plants being thus freed even for a time from attack, and helped afterwards by the use of the hoe, will be able to grow past the danger of being seriously injured.

With regard to estimate of damage, Mr. Hart mentions that whilst one stack from eight acres of Peas that were *not* infested contained twenty-two loads, the piece of six acres that *was infested* only produced eight loads, a load being as much as may be comfortably drawn by two horses in a four-wheeled waggon. Altogether the loss was estimated at not less than £20.

Mr. Russell Swanwick contributes the following note of injury caused by Pea Weevils at the Royal Agricultural College Farm, Cirencester. He says—The ravages of the Pea Weevil have this year been most serious. They not only attacked Peas, but also Vetches just as they got into their second leaf. Five acres of Peas sown February 23rd, and three acres sown a little later, were eaten to the extent of two-thirds, leaving only one-third of the plant to battle with the Weevil, and this remnant was so much eaten round the edge of the leaf as to be greatly weakened.

Another acre of valuable Garden Peas, which were being grown for seed, and were sown on March 15th, also had fully half the crop destroyed by this Weevil.

Two acres of Vetches were entirely eaten by them, and had to be ploughed up. Six more acres were badly injured.

The actual damage cannot be calculated from the loss of crop only, as to this must be added the damage from the growth of weeds

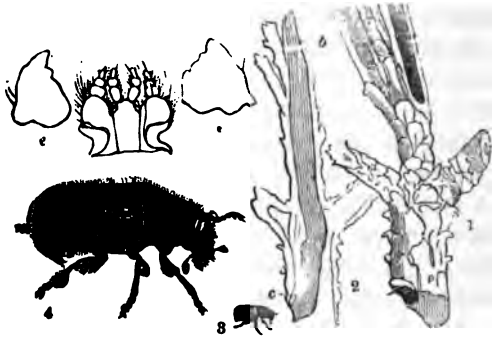
owing to the thinness of crop. There is no doubt the Weevils would not have done a quarter of the injury had it been a growing time, but the weather was cold, and the Peas could not get away. The loss on the nine acres of Peas cannot be put at less than £50, without reckoning the increased foulness of the land and loss of straw together probably £20 more. On the Vetch crop the damage was over £20.

For all from £90 to £100 loss must be laid to the score of this insect pest.

Professor Allen Harker, writing from the Royal Agricultural College on the subject of *Sitones* in the Peas and Vetches, mentions —"I have no doubt they hybernate, as individual specimens have occurred now and then since January."

PINE.

Pine Beetle. *Hylurgus piniperda*, Curtis.



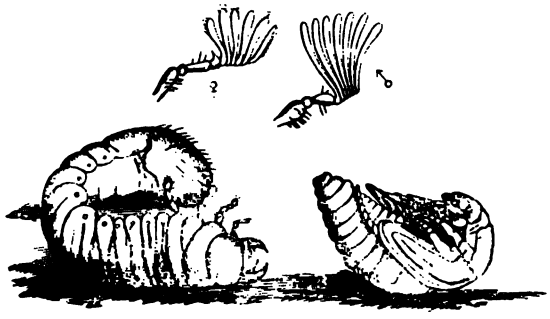
1 and 2, Pine shoots pierced by beetles; 3, 4, Pine Beetle, nat. size and magnified; *e e*, jaws; *f g*, chin, with feelers, &c., magnified.

Mr. Robert Coupar, Old Scone, N.B., remarks relatively to Pine Beetles having been observed laying their eggs in the bark of growing trees, that he has noticed this, but that in every instance which he observed the trees had fallen into a sickly state, and therefore were quite suitable for attack from the beetle. He remarks that although the beetles do not breed in trees too far gone in decay, yet that he has never met with quite robust and healthy trees being selected for egg-laying and breeding purposes, but the most healthy are attacked by the beetles for food, and in these they tunnel the young shoots. Mr. Coupar notes that in one young plantation where attack was bad he found many of the *cones* tunnelled.

The best methods of keeping off attack are noted (as before) to be

clearing off forest pine rubbish, so as to prevent egg-laying; and picking off the young shoots by hand when the beetles are seen working in them.

Cockchafer. *Melolontha vulgaris*, Stephens.



GRUB AND CHRYSALIS OF COCKCHAFER.
Club of the horn of male (♂) and female (♀) Cockchafers.

Any information as to measures that have been found serviceable in clearing Chafer grubs from plantations or other ground would be gladly received, as they are the cause of great loss in some of our Colonies as well as at home.

On the 20th of June I received information from Mr. T. J. Turnbull, agent to the Earl of Shaftesbury, relatively to the very serious injury caused by Cockchafer grubs to young seedling Fir. The grubs forwarded were of various stages, some apparently fully grown, and the young Firs, which were about 10 or 12 inches high, were being destroyed by the gnawing of these grubs removing the bark in large patches from the main root of the seedling Fir.

Mr. Turnbull mentions thousands of the Fir plants having been destroyed by the grubs in the previous year, and that they appeared likely to do as much harm in the present season. "They did not seem to inhabit the black sandy soil, but made their home in the stronger clay loam."

No remedy appears to be known in cases like this excepting encouragement of rooks.

Mr. Malcolm Dunn, writing from Dalkeith, says—"We suffer very little in Scotland from the attack of the Cockchafer grub, and it seldom touches the roots of Pines with us. About 18 years ago, whilst I was living at Eardiston, in Worcestershire, we had a young Pine plantation, mostly Scots Fir, very badly injured by the grub of the common Cockchafer, which devoured the roots close to the collar, causing the trees to turn yellow, and many of them died. The

following year, 1865, the attack was not nearly so bad. We tried no remedy, but the rooks and insect-eating birds eagerly devoured the grubs wherever they found them."

In the case of turf infested by Cockchafers, Mr. James Forrester, Bryanston, Blandford, notes rolling as a useful application, as well as encouragement of rooks. He observes—"A large lawn of old turf became the haunt of rooks in April, but were scared, and the turf was soon yellow and nearly dead. On examination the Cockchafer Beetle was found to swarm, but by heavy rolling the turf was saved. Since that year the rooks have their full feast on the lawn in the spring, and it is evident that they clear the beetles, as the turf has been perfectly preserved.

In the 'Transactions' of the Entomological Society of Ontario, 1881, mention is made of moles proving very useful in clearing grubs of one of the Canadian Chafers, *Lachnosterna fusca*, from a piece of badly-infested Potato ground broken up from turf. Many of the Potatoes had been partly eaten by the grubs, but wherever a mole-run traversed a hill of Potatoes no grub was to be found, even though the half-eaten Potatoes were proof of his former presence.

Where the ground is without crop turning on pigs to follow the plough is a good plan, but it does not appear practicable at present to get rid of the grubs in occupied land by any dressing that will not hurt the crop. I have tried the Paris Green (experimentally) without finding any effect.

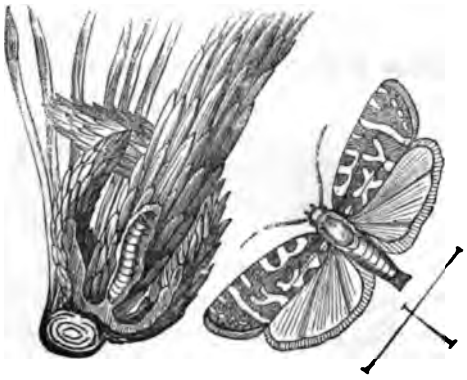
Where the ground is not occupied (and the materials are procurable) very heavy dressing with gas-lime in its fresh caustic state, or "chemical waste," which can be procured at little more than expense of carriage from alkali works, would be very desirable applications. The applications are equally destructive to everything they touch at first, and good manure, where gypsum is serviceable afterwards; but the fact of the "waste" being procurable for carting near the works has caused it to be much used in some localities as a destroyer of plant vermin and weeds.

Pine-bud Tortrix Moth. *Retinia turionana*, Hubn.

On the 15th of April Mr. Coupar forwarded to me some twigs of Scotch Pine, *Pinus sylvestris*, taken from a plantation nine or ten years old, with the note that the insect of which this contained pupæ did much harm in young Scotch Fir woods.

On examination I found that the shoots, or rather sprouting buds, were more or less coated at the base with turpentine, which flowed from the injuries caused by the caterpillar. In some instances most of the buds had perished, and the end of the shoot become little more

than a diseased mass of broken matter and turpentine, and in several cases one of the largest of the cluster of buds was completely cleared out, so that the bud would break off to a touch, coming away like a hollow cap.



Pine shoot injured by caterpillars of a Tortrix Moth; Pine-bud Tortrix Moth, magnified; line showing nat. size.*

Two brown chrysalids were still present, and in other buds, judging by their condition, the moth had only recently developed out of the chrysalis and left the hollow bud.

With regard to their history, Mr. Coupar says that the moths lay their eggs around and about the buds of young Pines in summer and autumn. After a time these hatch, and the caterpillars from them eat their way into the bud at its base—that is, into the bud which has been formed for the following year.

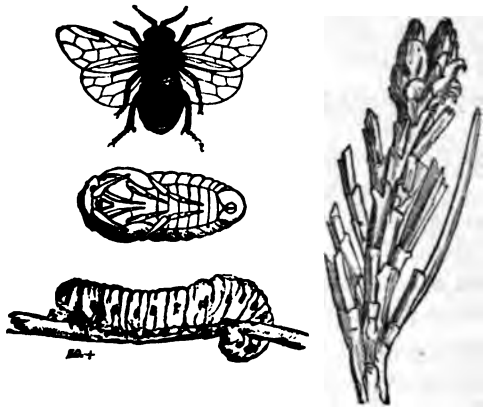
These caterpillars eat the whole inside from the bud, leaving nothing but a thin outside shell, and after they are full fed they turn to the chrysalis state within the bud they have thus hollowed out. From this the perfect moth comes out—in some cases seen by the observer—about the end of April or beginning of May, but in the present year some caterpillars were still unchanged towards the end of August.

It is noted that the damage caused by these caterpillars may easily be known by the straggling appearance and loss of the regularity of growth of the trees from the injury to the buds and leading

* The *R. turionana* has the fore-wings of a reddish or tawny orange, varied with silvery markings; the hind wings a greyish tint; and the above observations of the date of the first appearance of the Moth seen by Mr. Coupar (which was confirmed by the state of the specimens sent) and mention of the caterpillar being seen in August point to the development extending over a longer time than is noted in the German forest observations. The only remedy known appears to be to cut off and destroy buds or shoots which from their external appearance are seen to be infested.—Ed.

shoots, and this species, the *Retinia turionana*, is considered by the observer to be as hurtful as the *R. buoliana*, as in each case the shoot is spoiled, by the first named in the bud, by the second during growth of the shoot.

Pine Sawfly. *Lophyrus pini*, Curtis.



Pine Sawfly, chrysalis, and caterpillar magnified; Pine leaves eaten by caterpillar.

It is noted by Mr. D. Scott that on a detached estate to the East of Forres there has been attack (for the fifth or sixth year in succession) from the Pine Sawfly. In the present season he tried the solution of soda and water mentioned at p. 44 of the Report for 1881, and found it was effective in clearing the caterpillar, but from the inconvenience of applying it in sufficient quantities he could not speak with certainty as to results.

He also observed (as he had done in the previous year) that a cold wet day or two were very effective in causing the caterpillars to disappear.

Mr. R. Coupar mentions that there was no attack of Pine Sawfly this year at Colenden, Perthshire, but that further to the North he had observed a young Pine plantation of about ten years old which had suffered from attack last year, and which had been again attacked so severely this year that the young trees were completely stripped of their foliage. The ground on which the plantation was formed had for a long time before lain uncultivated and covered with heath and bracken ferns.

The observer considers where the plantation is otherwise healthy and thriving that setting boys to hand-pick the grubs would be serviceable.

(Search in autumn or winter for cocoons lying in the ground at the roots of trees that have been seen to be infested during the previous season, could not fail to do good, for though the Sawfly may and does come on the wing from many places, and lay eggs on the trees to set up attack, it is very certain that the Sawflies which hatch in spring or summer from the chrysalids at the foot of the trees are most likely to attack the trees above them, and in the instances above mentioned the successive generations appear to have been doing this.—Ed.)

Spruce Cone-gall Midge. *Cecidomyia* (*? albilabris*).

On February 10th two fine Cones of the common Spruce Fir were forwarded to me by Mr. Coupar from Colenden, near Perth, with the information that they were infested by a small Fly or Beetle, which caused a gall growth.

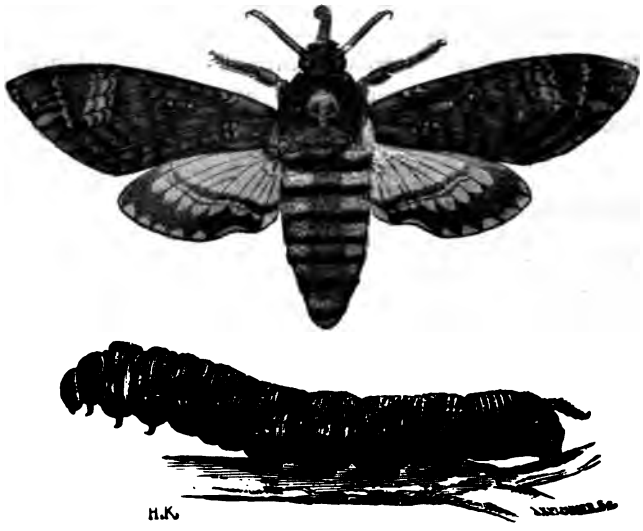
He observed that he thinks the insect pierces the Cone whilst it is still young and green to deposit its eggs, and when the Cone is matured in autumn that the fly is then in its larval or maggot state.

On examination a little gall growth containing a silken-lined cell was found at the base of several of the scales of the Cone, and on submitting a Cone to Mr. R. H. Meade he found in one of the galls the pupa or chrysalis of a *Cecidomyia* (a small midge or gnat-like fly), much resembling the perfect gnat in shape, with its imperfectly-formed wings and its legs folded under it. During the summer *Cecidomyiæ* hatched from the Cone I kept, which Mr. Meade believed to be *Cecidomyia albilabris*, but from my specimens having been injured before I could send them, he could not speak with certainty.

It will be of interest to complete this observation of the Cone-gall forming Midge next year; the figure of the Wheat Midge (p. 19) gives a general idea of its appearance.

POTATO.

Death's Head Moth. *Sphinx atropos*, Linn.



Death's Head Moth and caterpillar.

On October 10th a specimen of this splendid moth was captured by Mr. J. L. Sinclair, at Stanger Gill, near Thurso. The caterpillar feeds mainly on Potato leaves, but rarely occurs in sufficient numbers to cause serious damage.

TURNIP.

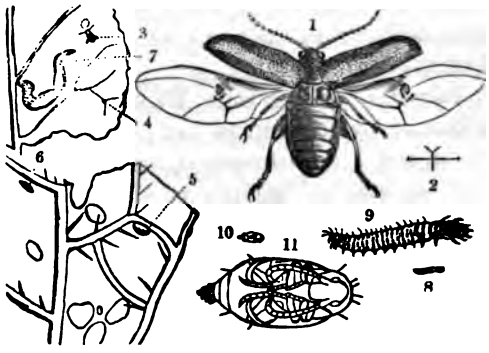
Turnip Fly, *Phyllotreta nemorum ; Phyllotreta undulata.*

During the past season injury from Turnip Fly has been scarcely noticed by any contributors, and the following notes of absence of attack in some places, and from others of appearance of the "Fly," but of its increase and ravages being checked by moist weather suitable for Turnip growth, pushing on the plant into the rough leaf, are of much interest to compare with the precisely contrary state of affairs in 1881.

Professor Fream, writing from the College of Agriculture, Downton, on June 26th, mentioned that early sowings of Turnips and

Swedes had quite escaped the Fly, owing to the somewhat too copious rains which fell in that locality.

At W. Worldham, Alton, Hants, Mr. Turvill mentions that he "found the ubiquitous little fellow, together with his cousin, the



TURNIP FLY. *Phyllotreta nemorum.*

1—3, *P. nemorum*; 4 and 5, eggs; 6—9, maggot; 10 and 11, pupa; all nat. size and magnified.

'brassy,' snugly ensconced in the hollow stems of both hops and nettles, but the opportune showers effectually disposed of all danger as to Turnip Fly for the season."

Mr. Hart, Kingsnorth, Kent, mentions that, as might be expected from the abundance of Turnip Flea last year, it was very plentiful and troublesome in the early part of this season, and some first sowings were lost in the neighbourhood of Kingsnorth, but circumstances were apparently not favourable for its increase, and by the time that Swedes were up it had become quite scarce.

Turnips were therefore good, and at the sheep fairs lambs were from 10*s*. to 12*s*. each dearer than last year, which was to a great extent owing to there being a good supply of winter food.

Mr. R. Cooke mentions that at Detling, near Maidstone, this gave little or no trouble.

Going further north along the Eastern Counties, Mr. E. A. Fitch observes that in Essex throughout Dengie Hundred he should think there never was a better plant known of anything excepting Clover.

The Rev. J. H. White, writing from Weybread, Suffolk—a parish which suffered very severely in 1881 from Turnip Fly—mentions that the crops have been very free from insect injury, and there has been no attack of "Fly" this season.

The Rev. R. Cooper, Swayfield, Grantham, Lincolnshire, reports the crop of Turnips as healthy, and, with the exception of some

patchy places, fully up to a good average, but that in enclosed gardens the Fly was very destructive.

Mr. Hayward, writing from the neighbourhood of Hereford, mentions that there has not been any appreciable injury from ravages of insects, either to corn, seeds, or root crops in that locality during the current year (1882). [In the previous season, 1881, a large part of Herefordshire was shown by the many returns sent in to have been heavily visited by the Fly.—Ed.]

Mr. James Edwards, writing from Woodhorn Manor, Morpeth, says—"To the best of my belief there has not been a single Turnip Beetle on my farm, and I have frequently searched for one to show my pupils without success." This locality was one that suffered badly in the previous season; and the absence of Turnip Fly attack during 1882 is still more remarkable in the southern counties of Scotland, the district of the worst of the attack of 1881.

Mr. R. Service, Maxwelltown, Dumfries, reported that the district of the western part of Dumfriesshire and all Kirkcudbrightshire had been remarkably free from insects. The fine growth of vegetation never gave the insects a chance, and hence the comparative immunity.

Mr. Muirhead, Haddington, says we have had no injury from Turnip Fly in this county this season.

Mr. P. Loney, writing from Marchmont, Berwickshire, N.B., where Turnip Fly caused serious havoc in 1881, mentions that in 1882 this kind of attack was almost entirely absent, and the crop of Turnips in the county the largest that had occurred for many years.

Mr. Malcolm Dunn, writing from Dalkeith, mentioned that Turnip Fly began its ravages in the earlier sown crops, but the heavy and seasonable rains of the early part of June put a stop to the attack.

Crossing now to the West of Scotland, Mr. James Kay, Rothesay, Isle of Bute, mentions that this season the Fly seemed to be almost absent.

At Torloisk, Isle of Mull, Mr. Grierson reports that Turnip Fly did little damage either in the garden or the field, and adds—"I do not remember a season in which we have been so little troubled with insects; it has been a rather wet summer. *More rain* fell in the preceding summer (1881), but in this (1882) there were *more days* on which rain fell. This was one of the few localities in which in 1881 field Turnips were reported as escaping Fly attack entirely, the heavy rainfall, amounting to 5 inches in June, and 8·80 inches in July, being noted by Mr. Grierson as having forced the plants very fast into rough leaf.

At Colenden, Perthshire, Mr. R. Coupar notices it could not be said there was any attack this year, for the young Turnips got into

rough leaf so fast that they were out of reach of injury before the Fly did any damage.

If we take the above observations in connection with the state of affairs regarding Turnip Fly from 1879, we get a straightforward history thus—

1879.—Unusual amount of wet weather, followed (in various places noted) by growth of charlock, and generally by not being able to get on the land to clean it thoroughly, and thus through 1880 there was both extra food and shelter for "Fly." In 1881 the great burst of heat and drought that came about May was everything that "Fly" could want, or that Turnips could not bear, and we know the consequent losses. 1882 showed early in the season in some places a threatening of attack, but the weather was the reverse of that of the year before; but in almost all the instances reported the "opportune showers," "seasonable rains," or "fine growth of vegetation that never gave the insects a chance" were just what the Turnips needed to run them fast on to the rough leaf, whilst at the same time the rainfall helped to wash some of the Fly from the leaves, and to keep the rest much quieter—that is, much less able to move about when frequently clogged with moisture, and therefore eating and multiplying less than when in heat and drought the creatures are leaping in full activity or on the wing.

The late months of 1882 have been very wet, and though we cannot forecast surely, yet if heat and drought come in May it appears likely Fly will be again very troublesome, and it may be submitted that special attention to the points in the common course of cultivation, which were shown in the Reports of 1881 to be suited to give rapid germination and hearty growth, *could not fail to be of use, and might save great loss.*

Mr. Silvester's notes bear very practically on the different effect of sowing in weather suitable for running the crop on well, or in a dry time.

Mr. F. Silvester, writing from The Hedges, St. Albans, observes—I am glad to be able to report an entire immunity from the attack of Turnip Fly this year in the *Swede crop.* I attribute this to the genial weather at the time the bulk of the crop was sown, germination and after growth being of too rapid a character to render the young plants liable to injury.

I was rather later in sowing White Turnips than usual, owing to a protracted hay time, and as dry weather set in after the seed was sown the Fly gained too strong a hold, and only half a plant was the result.

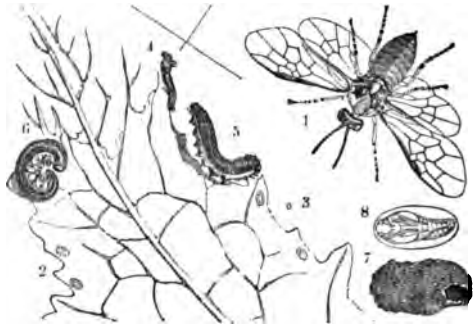
The following remarks were the only notes that I have received as to attack, together with means of prevention:—

Mr. Allen, of Thurmaston, notes that having ten acres of Turnips

much attacked by Fly and Wireworm he had the field rolled over early in the morning (whilst the dew was on the ground) four different times. This saved the Turnip by crushing the flies into the ground with the roller, and also by dirtying the leaves, and the crows took the Wireworm.

Mr. John Box mentions that at Farningham he has seen sawdust mixed or worked with gas-tar, so that it could be thrown as a dressing by hand, prove serviceable in checking attack on several acres of Turnips. The field so dressed was saved, whilst the plant in the adjoining field was entirely lost, excepting on the ground nearest the dressed field, which appears to have thus partially benefited by reason of a sharp wind blowing towards it at the time of hand sowing the dressing.

Turnip Sawfly; "Niggers." *Athalia spinarum*, Fab.



Caterpillars, pupa, and pupa-case. Sawfly magnified, with lines showing nat. size.

A slight attack of this Sawfly is mentioned by Mr. Geo. Brown as occurring at Watten Mains, Caithness. It is noted "the damage sustained was but trifling, still where they were at work can easily be seen, as there is nothing left of the leaves but the ribs.

Turnip Weevil. *Ceutorhynchus contractus.*

Mr. Geo. Brown mentions that at Watten Mains, Caithness, they were again visited this year by the small Weevil, *Ceutorhynchus contractus*, which was so destructive in the season of 1881. These first made their appearance on early-sown Swedes, but owing to fine growing weather the plants got rapidly forward, and were fit for singling before the insects could do a great deal of damage. This, however, was not the case with the later sown Yellow Turnips, which suffered very much from the attack of this pest, a great breadth

throughout the country being almost entirely destroyed, and on the observer's own farm a field of twenty acres was badly injured. It is noted that whilst fields sown about the same date—that is, the 25th June—suffered severely, that others sown earlier or later escaped entirely. This is considered to point to weather influence, more especially as it was observed that a few days after the Swedes were sown there was a week of intense heat, which would at once be favourable to the insects, and keep the tender braird back under their power.

In the case of a field of Yellows attacked it was thought best to allow the crop to remain, as the season was too far advanced to re-sow with any chance of success. In a short time it came into rough leaf, yet still the insects went eating off nearly as much daily as the growth made, so that the crop remained stationary during a period of eight days. Moist warm weather then brought the crop on, but for a long period they did not assume a healthy appearance, and at the date of writing, late in the autumn, the state of the crop was disappointing.

In the very careful account given by Mr. Geo. Brown of the attack of this Weevil in 1881 (see Report, pp. 102—105) it is noted that benefit occurred from dusting the attacked plants with quicklime, also that the amount of Weevil presence was less where gas-lime had been used as a dressing in the previous autumn, and more where the land had been foul with charlock.

* The figure here given of the Turnip Gall Weevil, the *Ceutorhychus sulcicollis*, gives a fair idea of the above-mentioned kind.

1—5, Gall with maggots nat. size and magnified; 6 and 7, Weevil, nat. size and magnified; 8, leg of Weevil, magnified.

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REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

AND

COMMON CROP PESTS

DURING THE YEAR 1883,

WITH METHODS OF

PREVENTION AND REMEDY.

BY

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PREFACE.

In offering my Seventh Yearly Report to the contributors who have favoured me with notes of observation, I once again beg them to accept my sincere thanks for their very serviceable information.

Further, I should be doing wrong in not acknowledging the great obligations I am under both to the agricultural and general press not only in encouragement of my endeavours, but also in drawing attention to the great importance of the subject of *practicable* agricultural measures being often available at a paying rate to save the field crops from attack, or carry them through it. I also gratefully acknowledge the kind assistance I have received from Professor J. O. Westwood, Life President of the Entomological Society, Mr. R. H. Meade, and Mr. G. B. Buckton in naming specimens I was unacquainted with. To all I tender my hearty thanks, and earnestly request their continued kind assistance.

The most severe attacks of the past season of 1883 have (chiefly) been those of Fly-maggots and grubs of various sorts. Daddy Longlegs grubs were a general trouble; so were Cabbage and Turnip-root maggots; and likewise the maggots of the Celery and Parsnip Leaf-miner; and in some places those of the Mangold Leaf-miner. More information is much needed as to the means of prevention and remedy of these four kinds of attacks, and also as to the reasons of the prevalence of the last two.

Mangold-leaf maggots have hitherto been supposed, in this country, to belong to only one kind of Fly, but there appears now reason to think that other kinds may be present, and therefore specimens of Mangold-leaf maggots would be very acceptable in the coming season, as points in the habits of the Flies they

turn to may thus be made out, which may help us to check attack.

The observations on Hop Aphis are still quite imperfect. These are given as an Appendix, as it was desirable to distribute them amongst observers before the date of issuing this Report; and since then I have received information (from previous observations given by two careful observers) respectively of the Fly having been seen on young Hop just coming out of the ground, and of the nits being found at the lowest part of the stem and gradually spreading upwards. I have reason to believe these observations perfectly correct and very important. Further information would be particularly acceptable regarding Hop Aphis.

Reports have been sent in regarding several kinds of attacks to fruit crops, which are important in orchard-farming, many of which, it will be observed, may be prevented or forestalled by any measures (such as having sheep present in orchards, or skimming the surface-soil in gardens) which will get rid at once of the fallen infested fruit, or the infested surface-soil, before the grubs go through their changes.

One great point of the observations of the past year is the notice taken of the presence of grubs and maggots of various kinds that infest the roots of our farm crops being also found in dung, farm manure, and compost heaps, and thus carted on to the fields.

This is one of the broad subjects, like amount of bird-presence, which bears on all agricultural practice, and which we need to know more about. It is not a question of withholding farm manure, but of *not permitting neglected or weed-grown heaps* to become head-quarters of Daddy Longlegs grubs, &c. Likewise, as there are many kinds of maggots whose whole history is not known, which are found in dung and compost heaps,—and also we find crops "going off," as it is termed, from attacks of maggots of which little has been recorded save that they have been found in *rotting material*,—it would be very desirable to have specimens and notes of these maggots whereby to make out their whole history.

This subject has been brought forward in clearer and better form than I can place it in the circular issued by the Royal Agricultural Society requesting observations, of which the main points desired are there fully given, with pages for entries. I

shall have pleasure in forwarding copies of this circular to all applicants, and shall be greatly obliged for observations and specimens of maggots from the localities there specified.

The subject of attention to insect-ravage has spread widely and serviceably during the last year both at home and in the Colonies; at Port Elizabeth in Cape Colony, in Australia, and also in the sugar-cane plantations of the West Indies and the coffee plantations of Ceylon, the agriculturists or the planters are learning the use of attacking the attacker themselves on the basis of *their own knowledge* from observation *of its habits*, instead of wasting time on specific descriptions *only* leading to its name, and the benefit is appreciable now, and we may hope it will be great.

In our own country such an important example as to possibility of teaching all that is needed on this subject for common farm use has been given by the plan carried out at the Aldersey Grammar School, Bunbury, Cheshire, that, as enquiry is often sent me as to method of conveying instruction,—and I am sure such instruction may well be classed amongst "means of prevention and remedy,"—I, with permission, append the description of the plan followed in a note.

The illustrations in the present Report are chiefly from electros of the blocks by John Curtis in his 'Farm Insects,' the use of which I am permitted by Messrs. Blackie, of Glasgow, and acknowledge with thanks for their constant and courteous assistance. I also express my acknowledgments for the use of some figures by Prof. J. O. Westwood and John Curtis, which are allowed by the proprietors of the 'Gardeners' Chronicle,' and likewise for some from Newman's 'British Moths,' permitted by Mr. Allen.

I again, with hearty thanks to all those who kindly favour me with information for publication, earnestly request their co-operation in the coming season.

ELEANOR A. ORMEROD.

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1884.

NOTE.—The subject of how to set on foot instruction in country schools relatively to prevention of insect injury to farm crops, of a sound *plain* kind such as should be practically and truly serviceable for field use has so often been brought before me that I give here, with permission, the following information of the manner in which this has in the last three years been begun, and is being serviceably carried on, at the Aldersey Grammar School at Bunbury, near Tarporley, in Cheshire.

This old-established school is under the government of the Worshipful Company of Haberdashers of London, and, at the suggestion of J. Curtis, Esq., a member of the court, as to the importance of the boys of this agricultural district receiving instruction as to the means of preservation of the crops from insect-ravage, a pecuniary grant was liberally given by the Company for necessary working materials, and, with the addition of a very few books on the subject, plain and sound, but of small cost, of the six Diagrams of Crop Insects of the Royal Agricultural Society (procurable at 5s. to 8s., paper or cloth), and a few other large coloured drawings, and also the gift of a microscope by W. H. Baigent, Esq., one of the past Masters of the Company, all that was needed for a start was collected.

Under the efficient direction of the Head Master, Mr. W. Bailey, the boys received a course of lessons on insect-life, illustrated by *living specimens* and diagrams, the instruction given being thus made perfectly intelligible, and further carried out by the scholars themselves collecting and bringing specimens, and, where necessary, given the use of the cheap and simple apparatus known as a breeding-cage, in which they could watch the changes from the maggot and larval state to the pupa. The pupils thus shortly became well acquainted with the common crop-pests, such as Click Beetles and Wireworms, Turnip Fly, Leather Jackets or Daddy Longlegs, Cabbage and Turnip-root grubs, &c. In fact, *the* great step was made; by the simple but sound method of teaching pursued the boys had learnt to know *the crop-pests* by sight, without doubt or mental worry, just as they knew *the crops* that the insects infest.

Having thus gained a knowledge (by their own observation, under Mr. Bailey's guidance) of the appearance and habits of the crop-pests, the next step was to learn to know how to turn the knowledge to practical service. This movement met the full approval of the neighbouring farmers, and on the appearance of attacks methods which have been advised in these Yearly Reports on the authority of many of our agriculturists were tried,—as, for instance, for Daddy Longlegs grubs, &c.,—and much good was done.

The school, being situated in the middle of a large and purely agricultural district, in a few years the majority of the scholars will be either the farmers or the farm-labourers in the parish, and (instead of being, as in many cases, utterly in the dark as to what is injuring the crop) they will come prepared, not *merely* with names, but with *a knowledge which is a part of themselves*, enabling them to tell what is going on by the state of the injured crop, and also aware not only of the means of prevention or of lessening the effect of ravage, but of the *reasons* for the various methods of treatment.

The success has been so satisfactory that I take leave to draw attention to it here, as meeting a great want, and showing how by practical plain instruction (and without taking the place of necessary school studies), and without an instructor added for this special branch, and with the full approbation of the governors of the school and of the neighbouring farmers, and likewise with the approval of the examiners of the school and the agricultural visitors, the plan has been brought to work.

I do not give details here, but, having had the pleasure of in some slight degree co-operating from the first with the Head Master and the members of the Company in their useful work, I should feel great satisfaction in giving any information as to the books used, or other details, to any who may apply to me.—ED.

NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS

AND

COMMON CROP PESTS

DURING 1883.

APPLE.

Apple Sawfly. *Tenthredo testudinea*, Steph.; *Hoplocampa testudinea*, Cameron.

THE attack of Apple Sawfly caterpillars has not often been recorded, but is sometimes the cause of much mischief in the first stage of the crop, by means of the caterpillars feeding inside the young forming Apples.

On June 25th I found many small Apples, under trees from which they had fallen, in my garden near Isleworth. Some of the Apples were about an inch long, many were smaller. Most of the larger ones had a blackish mark on them on one side, or near the stem, and, on opening them, the inside was found to have been eaten away, so as to form a hollowed-out chamber from the mark or hole in the side to the centre and some way past it. This was filled with decayed matter formed of the gnawed pulp of the young Apple, and in this decayed matter there was in many cases one Sawfly caterpillar.

These were of various sizes (the largest about half an inch long), whitish, with a pinkish streak along the centre of the back. The largest specimen did not show the streak, very possibly from coloured matter in the food-canal having been discharged. The caterpillars are distinguished from Moth and Beetle grubs by having *six pairs of sucker feet beneath the body*, besides the pair at the end of the tail, and the three pairs of regular claw feet.

The caterpillars, on being disturbed, gave out a strong smell, something like that of the common plant-bugs (or bed-bugs), or that of the Goat Moth caterpillar. Some of the injured Apples had been already deserted by the caterpillar, which goes down into the ground for its change.

The method of attack is stated to be for the Sawflies to fly in May to the Apple blossom, and lay their eggs on the embryo fruit. Within this forming fruit the caterpillar feeds, until it falls, towards June or July, within the injured fruit, and then, creeping from it, goes down into the ground, where it forms a cocoon, in which it remains inactive until the following year.

(From my own observations I incline to think that the caterpillars also sometimes leave an infested fruit and make entrance into another from the outside, as, amongst the collection of Apples I made, I found one of the caterpillars with only about a quarter of its length sticking out of an otherwise uninjured Apple, into which it was then burrowing.)

The caterpillar turns to the pupa, and thence to the Sawfly in the cocoon below ground, and in the attack noted by Professor Westwood,* as observed by him in his garden at Hammersmith, he mentions that in the middle of May he found the Sawflies, which had come out from the cocoons, hovering about the blossoms of the Apple trees which had been infested the previous year, and distinctly saw one of the female Sawflies laying her eggs within the blossom.

The Sawfly is very like the Turnip Sawfly (figured under that head) both in size and shape, perhaps rather smaller, and may be generally described as reddish or pale orange coloured, and black, or largely mottled with black, above. The caterpillar differs from that of the Turnip Sawfly in having one pair less of sucker-feet, and is, as above mentioned, whitish, with an ochre-coloured head.

The attack was very destructive to Apples in my own garden, and on enquiry I was informed that much harm was being done just in the same way in the neighbourhood of Isleworth.

When the small Apples are found to be falling, which is often the first information of attack, of course nothing can be done to save the killed fruit, but a repetition of the attack next year may be in great degree prevented by having all the fallen Apples picked up as soon as possible, say twice a day. The caterpillar often remains some little time in the fallen fruit, and, if all the Apples are gathered up *and destroyed*, a great many caterpillars will thus be got rid of.

Where the soil under the attacked trees is not disturbed by cropping during summer, coming injury may be much lessened by skimming off the surface-soil in autumn or winter, and destroying this with the

* 'Gardeners' Chronicle,' 1847, pp. 851, 852.

caterpillars or chrysalids in their cocoons, which are lying in it,—the same treatment, in fact, which answers well in getting rid of Gooseberry Sawfly caterpillar. Also it has been found that the Sawflies may be serviceably lessened in number when they are attacking the Apple blossom by shaking them down from the branches on a cloudy day, or when they are torpid from bad weather, and destroying them by sweeping them off cloths laid on the ground beforehand, or in whatever way may be most convenient.

Small Ermine Apple Moth. *Yponomeuta padella*, Stephens; ? var. *Malivorella*, Sta. Cat.

YPONOMEUTA PADELLA.

Small Ermine Apple Moth; caterpillars, nat. size and magnified, and cocoons in web.

The Small Ermine Apple Moth (the *Yponomeuta padella* of many authors) does great harm to Apple trees and Hawthorns.

This Moth lays her eggs in patches on the small twigs, covering them over with a kind of gum, and under this patch the little caterpillars, which hatch about October, live until next spring, when they come out and are stated to burrow *into* the young leaves and feed within for a while. When strong enough they come out, which accounts for the surprisingly sudden appearance of attack. They then feed on the leaves and spin webs, reducing the attacked hedge (or tree) to the dirty ragged appearance too well known, and in the webs the caterpillars shelter in companies, and also, when full-fed, the caterpillars draw near together in their common web, and each spins for itself a cocoon, in which it turns to a chrysalis, from which the Moth comes out about June. These are of the shape figured above, but very variable in the depth of the tint of grey of the black-spotted upper wings. The kind figured above by Professor Westwood has the upper wings white, and is named *Malivorella*, from especially infesting Apple; but the habits of these two species (or varieties of *padella*) are so much alike, the same means of prevention are serviceable for both

these common attacks. Therefore, as the Apple is the most important, I have made the following short note of an attack on Hawthorn a reason for drawing attention to it:—

On June 29th Mr. A. Caldwell, Harrow Road, forwarded me specimens of webbed-up leaves and caterpillars, with the information that "the caterpillars have so completely devoured the leaves from one of our thorn hedges that we are afraid the attack will kill it altogether.

"We have cut all the growth the hedge has made this year to get rid of the pest; also to induce the hedge to break afresh.

"Part of the leafage which has not been completely devoured hangs all withered up, presenting a most unsightly appearance. I may mention that the hedge is within eleven feet of the edge of the Grand Junction Canal."

The numerous specimens forwarded developed into a large supply of the *Yponomeuta padella*, the Small Ermine Moth.

Where attack is on trees mischief may be stopped by snipping off the web-nests when the caterpillars are in them, and destroying them. Of course care must be taken to cut the nests *when* the caterpillars are within, and also it is desirable to hold a pail or something below in which the caterpillars which try to get away may be caught in any mixture thought serviceable. When the caterpillars have spun in the nest, then cutting the web off with the cocoons within will get rid of much future attack.

On hedges it is difficult to get rid of them, but, as the caterpillars let themselves down by threads on alarm, probably they may be got rid of by thorough drenchings applied by a garden engine (as with Hop Aphis) of soft-soap and tobacco, very dilute, or paraffin, and the caterpillars which fall being destroyed by trampling (which boys would manage in many cases) or by throwing gas-lime, quick-lime, or anything that would kill them.

Winter Moth. *Cheimatobia brumata*, Steph.

The caterpillars of the Winter Moths (see figure), and several other nearly-allied kinds, cause much mischief yearly to leafage (and especially to the leafage of Apple and other fruit trees) which might be much lessened by observing that, as figured opposite, the female is only possessed of *abortive* wings; consequently, if any measures are taken to keep the females from walking by means of their long spider-like legs up the trees to lay their eggs, the trees can be preserved from their attack.

The following communication from Mr. J. G. Strachan, of Farm Hill Park, Stroud, bears on this point. On the 22nd of October he wrote me:—

"We have had a plague of looper grubs on the outside fruit trees here, for the last two or three years, which destroys all the blossom and leaves also on the trees, and, although we have tried every remedy abroad, we have failed to cure it."

The further description of the grub being a pale green looper caterpillar about half an inch long when full grown, fairly suited the Winter Moth caterpillar, and, after advising smearing a band round

CHEIMATOBIA BRUMATA.

Winter Moth. Male, winged; female, with abortive wings.

the base of the trees with any sticky material which might stop the females in their upward passage, I received the following note from Mr. Charman, gardener at Farm Hill Park:—

"Nov. 10th. I have used Davidson's composition, and find it sticks fast everything that touches it, and I find a quantity of wingless female moths stuck to the base of the trees."

On Dec. 11th he further mentioned:—"I have caught upwards of 500 of the female moths, and they are still going up the trees, but I could not say that they were travelling up *every* evening. The method I adopt for catching them is as follows:—I paint the stem with the composition for about a foot, sometimes two feet if the tree is a standard. I then go round in the morning, or whenever I have the opportunity, which is sometimes not for two or three days, and with an old knife and tin lid to put them in, take off all the moths I can find attached to the composition and burn them.

"I found thirty yesterday stuck to one Apple tree, and I should think that each female would produce at least a hundred eggs, and some a great many more. I counted three hundred from one large Moth."

In this case the attack, judging from the specimens forwarded appeared to be that of *Hybernia Prosapiaria* (Westwood), a kind of Winter Moth a little larger than what is known as the "Common Winter Moth," figured above; but the treatment for all is the same.

In either case the female Moth *walks* up the stems of the trees she is about to lay eggs on in the late autumn or during winter (whence the name), and the simple process mentioned above is a most effectual preventive of attack.

If left alone this attack is as destructive to fruit trees as any that we have, and the following notes give some idea of the mischief it causes, and the need of a working remedy :—

Mr. J. W. Ellis, writing from Water Meetings, mentions :—" I enclose specimens of caterpillars that do much damage in this part of Lancashire. They damage the Apple, Cherry, Black Currant, and Gooseberry. We cannot trace them any nearer their commencement than to the young leaves when they unfold, and they are prevented from opening by a web. The caterpillar eats holes in the leaf and then leaves it, and begins to eat at the fruit, making one hole in a berry, and will then select another. The fruit so bitten invariably falls to the ground.

" We sometimes have half our crops spoiled by this insect. We cannot find out how it comes, nor into what state it goes. We have tried to destroy it by white hellebore and by lime-wash, but neither seemed to affect it. The caterpillars disappear about midsummer (June 20th to 30th)."

Dr. T. A. Chapman, Hereford, mentions :—" This spring the *Cheimatobia* has, within my range of observation, actually stripped trees of their leaves, and in one case half an orchard."

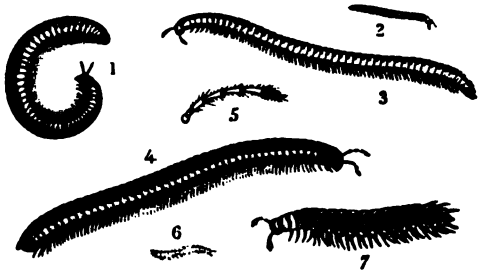
When once the green " looper " caterpillars of the Winter Moth have established themselves on a tree little can be done to check their ravage, excepting what can be managed by smart shaking of the boughs, so as to make the caterpillars let themselves down by threads, and then getting rid of them by trampling on such as fall and sweeping away all that may be dangling in the air beneath the branches with a pole, or any other convenient implement.

The caterpillars of the above-mentioned Winter Moths turn to chrysalids during summer, either in or on the surface of the ground beneath the branches of the trees they have been stripping of their leafage ; and clearing away the surface-soil and destroying it with the contained chrysalids, or slightly sprinkling fresh gas-lime on the ground so as to give the caterpillars a poisonous reception below when they are falling after they have come to full growth, would do good.

But in any case a sticky band, which isolates the tree from attack, is a cheap and sound treatment.

BEANS.

False Wireworms; Julus Worms. *Julidæ.*



JULIDÆ.

1, *Julus Londinensis;* 2, 3, *J. guttatus;* 4, *J. terrestris;* 5. horn; 6, 7, *Polydesmus complanatus;* all magnified; and 2 and 6, nat. size.*

The Snake Millepedes or Julus Worms, sometimes known as "False Wireworms," are not true insects, inasmuch as they never have wings throughout their lives. They remain very much like what they were when first hatched, excepting that with successive moults there is an increase in the number of their feet, from the three pairs they start with, up to a large amount.

The injury they cause is, however, so very like that of grubs, maggots, and wireworms, that they often pass as insects or insect allies; and the amount of harm they do makes it desirable to draw attention to them.

During the last season much harm has been reported as caused in various localities by various kinds of these Julus Worms or Millepedes.

One of the first observations I was favoured with about these pests was from Mr. W. Glenny, Barking, on the 17th of May, who mentioned that early-sown Scarlet Runners, or French Beans, in cool chilly weather, spear very slowly, and, if the land is cold and clung, they

* *Julus guttatus*, Fab., *J. pulchellus*, Leach, the "Beautiful" Snake Millepede, may be known by its ochreous colour, with a row of crimson spots along each side, excepting near the head and tail. After death this kind turns to a reddish purple tint.

The females of the *Julus* worms or Snake Millepedes are stated to lay their eggs in the ground from about the end of December until the following May, and young *Julidæ* live two years before they are perfect. They are to be found under clods of earth and rubbish, such as bricks, stones, and pieces of wood, as well as under bark, or in moss, or, in some cases, amongst dead leaves, and they are said to propagate most in undisturbed ground. All measures that would remove or break up such shelters or breeding ground would therefore be useful.

are exceedingly liable to foes before they show themselves above the surface. A sample of these enemies is forwarded. [These proved to be specimens of the Flattened Snake Millepede, *Polydesmus complanatus*, figured above at 6 and 7, nat. size and magnified, Ed.] They are not Wireworm, but work in the same way when the seed is germinating, and in the cleft between the two lobes of the Bean you will find them active. The plant, if not killed, comes up blind, and a gappy crop succeeds.

"The field where these were taken from is a marshy soil, and might have been grass some years ago: here one finds such creatures in great abundance."

[On the 20th of May more Beans and their pest were sent, some of which I found to be the Earth Julus Worm or Snake Millepede, *Julus terrestris* figured above at 4, magnified, Ed.]

On the 24th of September Mr. Glenny further mentioned:—"The Snake Millepedes did their work undisturbed, and a thin crop of Scarlet Runners was the result. It would have been impossible to stop them after writing to you, as the mischief was already accomplished."

Mr. Glenny suggests that it might be of service to mix carbolic acid (sufficiently diluted) with the seed before sowing, in the same way as Wheat is now dressed to keep away small birds. This would make the Bean unpalatable and less attractive to underground foes; and further, relatively to the suggestions I had offered, formed from study of the habits of the pest, it is observed:—"Your suggestions to move the ground frequently before planting, to eradicate all rubbish and garbage, to sow *not too early*, are what I can endorse entirely. By planting before the usual time the seed is longer in germinating on account of the lowness of the temperature; thus more time is allotted to the insects to destroy or feed upon the grain."

Mr. R. Cooke notes that at the Croft, Detling, near Maidstone, the Broad Beans, and to a less degree Scarlet Runners, were very much thinned between sowing and germination. They proved, when examined, to be full of centipedes, as many as sixteen in one Bean.

The question is asked, "Did the Beans die first, and the centipedes only eat the rotten seed, or did the centipede kill the Bean by eating it when still good?" I think the latter, as some Beans germinated and came through the ground with almost white seed-leaves.

Mr. J. Addison, writing from Mapledurwell, Basingstoke, mentions, with regard to measures of prevention:—"I forget if I told you that last season my mangels were much injured by the False Wireworm. I got rid of many of them by placing cotton cake just under the soil, and I found also (when too late) that salt easily killed the millepedes.

I also received specimens of the Spotted Snake Millepede from near Bradford as a pest very destructive to vegetation. In this case specimens of the present and last season were sent.

CABBAGE.

Cabbage Aphis. *Aphis Brassicæ*, Linn.

APHIS BRASSICÆ.
1, 2, male; 3, 4, female; nat. size and magnified.

After mentioning various bad crop attacks from insects or insect allies which have occurred this season near Barking, Mr. W. W. Glenny further notes:—"But the greatest loss has been from White Lice. They have descended in myriads upon Turnips, Savoys, and Cabbages. Some crops of the former have been annihilated, more particularly the autumn-sown pieces. No description of the Cabbage tribe has escaped. The produce now reaching the metropolitan markets from our district is damaged and reduced in value by these disgusting pests on the exterior covering.

"The leaves of the plant curl over the intruders in such a way that wind and rain hardly interfere with their devastating progress, and when the heart of the young and tender esculent is reached its doom is fixed, and the crop is settled."

The Cabbage Aphides probably take the name of "White Lice" from the light colour of the young when first produced, and, like Hop Aphis, how to get rid of them on a large scale of cultivation needs yet to be made out.

Something may be done in garden growing by cutting off the leaves which are infested as soon as ever patches of Lice are seen beneath them. The attack would then be prevented from spreading; and likewise, in garden cultivation, a good drenching of soft-soap with

a little tobacco into the hearts of the plants, where it would lodge and stifle the Lice, would be sure to do good.

Waterings with some plant stimulant, such as nitrate of soda, would also do good in keeping up a strong healthy growth.

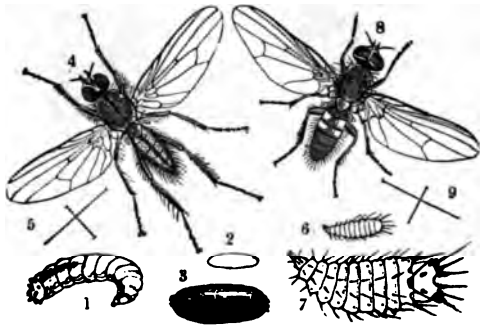
This Aphis frequents Charlock, Shepherd's Purse, and Wild Radish, all common weeds, and clearing off these early in the year would prevent these pests going on from them to the cultivated crops.

Cabbage and Turnip-root Maggot.

Cabbage Fly. *Anthomyia Brassicæ*, Bouché.

Root Fly. *A. radicum*, Curtis.

Radish Fly. *A. floralis*, Fallen.



1, larva of *A. Brassicæ;* 2, 3, pupæ, nat. size and mag.; 4, *A. radicum*, mag.; 5, nat. size; 6—9, *A. tuberosa*, larva and fly, nat. size and mag.

The attacks of "Cabbage and Turnip Maggot," like those of Wireworms, Daddy Longlegs grubs, &c., are best described, for common purposes, under the common English name, as there are at least three sorts so much alike in appearance, and in method of injury, that it is very difficult to tell them apart.

These three kinds of maggot are all much like the kind figured, magnified above at 1, whitish or yellowish, and legless, tapering to the head and cut short at the tail,—in fact, very like the well-known Onion maggot. They feed in or on roots of Turnip and Cabbage, as well as other plants, and in some cases in dung, and in a few weeks turn to chrysalids (figs. 2, and 3 magnified), from which very shortly a new brood of Flies comes out, which is directly in a condition to lay eggs and start a new attack.

These three kinds are all small two-winged blackish or greyish Flies, all of them much of the shape figured at 4, magnified; the cross lines at 5 give about the real length of the body and spread of the wings.

These three kinds are respectively known as the Cabbage Fly, the Root Fly, and the Radish Fly. The scientific names are given above.

The history of the "Cabbage Fly" is the one which appears to have been most recorded. It is stated* that sometimes the Flies, sometimes the chrysalids (pupæ) of the last brood of the year, live through the winter, and come out in the following spring. Then the females lay their eggs in groups of few or many, as the case may be, at the Cabbage plant, and *always as deep down as possible* at the lower part of the stalk, that is, below the ground. The eggs hatch in about ten days, and the maggots bore into the stems, the parts on which they feed soon beginning to decay. When full-fed the maggots turn to red or gold-coloured chrysalids in the earth, and the whole lifetime in summer, from the egg to the perfect Fly, amounts to about eight weeks, so that there is a rapid succession of attacks,

This is the kind which, together with the Root Fly, has been considered to do most harm, but, from the specimens sent me during the past season and previously, which have been kindly identified for me by the excellent skill of Mr. R. H. Meade, the common kind appears really to be that known as the Radish Fly.

On June 11th Mr. Reginald W. Christy forwarded me specimens of maggots which were feeding on roots of Cabbage, "and doing considerable damage"; over twenty were found feeding at one Cabbage root, and these proved to be maggots of *A. floralis*, the Radish Fly.

The method of prevention will be better studied after noticing the attraction of farm manure (especially when rank and new) for the Flies.

The following note of the method of attack, and also of the great amount of damage caused by Fly-maggot (of which specimens were sent accompanying), is by Mr. John Ward, Rainsdale, Nottingham:—

"Aug. 1st, 1883. I send to-day a box containing Turnip plants affected with maggots. . . . You will observe that sometimes the maggot enters the base of the root and lives there, but in other cases it seems to eat off all the small rootlets that usually spring from the side of the main root, leaving the plant dependent solely on one or two small fibres at the end of the tap-root.

"Sometimes it eats the neck of the Turnip all round until it severs the top from the root. As hundreds of acres in this district are affected with it, some information as to its life-history will be gladly received by myself and fellow-sufferers."

With regard to attack near Gloucester, Mr. J. Cummings, Newtown, Newent, mentioned that this year, for the first time, his Swedes were attacked by a white maggot, and the crop considerably damaged.

* 'Praktische Insecten kunde,' Dr. E. L. Taschenberg, pt. iv., p. 129.

At first the plant appeared checked and stunted, and eventually the bulb went quite rotten.

The land was a Wheat stubble, thoroughly well worked in autumn, and again in spring twice. Farm-yard manure (made principally from fatting beasts), at the rate of twelve to fourteen loads per acre, was ploughed in, and the seeds drilled immediately afterwards, on the flat, with burnt ashes mixed with Proctor's Turnip Manure, at the rate of 8 cwt. the acre.

The seed came up well, and the plants appeared perfectly healthy until after they were singled out, when they began to fail from the attack of a maggot which very much resembled a sheep maggot.

The headlands of the field were not planted till nine or ten days after, and only burnt ashes and artificial manure were used; these were perfectly healthy.

In the bad attack of Cabbage maggot at Admaston, Rugely, which I am favoured with an account of by Mr. T. Carrington Smith, the spread of the mischief was checked by a soaking rain. This is well worth notice, as whatever effect the sudden wet had directly on the maggots themselves, it would so wash down the mineral superphosphate and the nitrate of soda which had been given round the plants as to run on a vigorous growth past attack, and stop some of the coming attack also by closing up many crannies by which Cabbage Flies about could get down to lay at the Cabbage roots.

On June 15th Mr. Carrington Smith forwarded specimens of Cow Cabbage plants and Cabbage Fly maggots, with the information they were collected from a growing crop, and that, if the progress of destruction continued at the rate it had been going on during the week, there would soon be many gaps in a most promising plot of nearly two acres.

The plants had been procured early in April from Farnham, in Surrey, and got well established before the drought. The land on which they were planted had a good dressing of farm-yard manure, and 6 cwt. of mineral superphosphate in the ridge. There was also a sprinkling of (say) 2 cwt. of nitrate of soda per acre, distributed not all over the ground, but round the plants. Later in the year Mr. Carrington Smith mentioned that, shortly after the above communication, there came a good soak of rain, which seemed quite to stop the spread of the maggots to any other Cabbages.

The plants that were used for filling up the gaps did not seem to be attacked, although no local application was used; but at the beginning of August 1¾ cwt. of nitrate of soda per acre was sown broadcast all over the plot of Cabbages which then covered the ground.

There is doubt in this case whether the eggs from which the

maggots were hatched did not come inside the plants put into the ground on April 16th and 17th. It was remarked at the time of planting that a small proportion of the 12,000 plants were "hollow-shanked," and it is likely enough these might be infested.

It has been found (Rep. of Inj. Ins., 1881) that dipping the plants in a puddle of earth and cow-dung, or night-soil, taking care to smear the roots and stems well up to the leaves with the mixture, is a good method of prevention.

[In the following note observations are given of the good effects of dipping in soot and water. Probably the various applications act in the same way, that is, by choking up the pores along the sides, or *at the tail* of the maggot, by which it draws in the air, and thus stifling it.—Ed.]

Mr. David Byrd, Spurstow Hall, Tarporley, Cheshire, notes :—"It has been our practice for ten or twelve years to dip the Cabbage stems in thick soot and water, which keep off the grub. We did this to prevent the Rooks from pulling up the plant to get the small white insects which were to be found on the stems ; now we find it keeps off all pests.

"The loss of a few plants that are taken I attribute to the want of care in dipping, so that the stems did not get their proper share of the bitter protection.

"The dipping of the stems in soot and water is intended to ward off the maggot and other insects by giving a bitterness to the plant. If eggs or maggot were in the stem at planting-time, a good dipping for a few minutes would most likely make the plant unpalatable.

"In May and June last I found the maggot in numbers in the manure under Cabbage and Turnips. By dipping I believe I saved the Cabbage, and the Turnips by sowing artificial mannre (guano, 2 cwt., superphosphate, 3 cwt., salt, 3 cwt., at a cost of £2 per acre), which closed in the ridge, and would make the soil untenable to the maggot, and drive it to seek other food."

Mr. Ralph Lowe, writing regarding "Cabbage-root maggot" from Sleaford, Lincolnshire, mentions that in a previous year, after fallowing a twelve-acre field, this was dressed with 3 tons of fresh-burned lime to the acre, at a cost of 33s., leaving a strip of eighteen yards width down the centre of the field without lime, but with 15 tons of well-rotted farm-yard manure per acre. At the proper time the lime was slacked (by means of the water-carts), spread and ploughed in, and the whole field was put in with Turnips. Upon the lime the Turnips were a most excellent crop, rich-looking in the top, the roots heavy, clean, *free from mark of insect or grub* of any kind ; whilst the part that had been manured was far from being so satisfactory.

The following note turns on the help from Rooks in getting rid of the maggots, which in this case the birds seem to have managed without destroying more than the attacked plants.

Mr. Ralph Lowe says:—"I went to inspect a crop of Turnips where the white maggot was at one time threatening to commit extensive damage. The Rooks were persistent in tearing up the plants, and the occupier had in despair taken off the "tenter" with his gun, in which he acted wisely,

"I found that about ten acres had been unduly thinned, leaving about half a crop. But the Rook had done his work well; not only could no maggot in any stage of its growth be found, but not one injured Turnip. Wherever the grub had attacked a plant the Rook had pulled it up, and apparently carried off nearly the whole brood, leaving the Turnips in a perfectly healthy state."

Mr. W. W. Glenny, writing from Barking, September 24th, notes: —"The maggot at the root of the Cabbage has done mischief, and has occupied my attention to some extent. It seems that the only way to make circumstances disagreeable would be to dress the land with gas-lime, common salt, soot, or kindred substances that might by their pungent nature be obnoxious to its presence.

"At this time one field of mine has a good coat of refuse lime with a view to deterring its visits."

For some reason which it would be very desirable to know, but which at present is not clear, the Cabbage-root maggot does not appear to be known as a pest in the great Cabbage-growing district close to Hounslow and Isleworth. I have never been troubled with it at the roots of either Cabbage or Turnip in my own garden, but possibly constant applications of lime, gas-lime, and experimental chemicals of various sorts may account for its absence here.

In regard to the neighbourhood I have the following communication from Mr. John Wilmot, Derwent Lodge, Hounslow:—"In answer to your inquiry respecting the Cabbage Fly maggot I am pleased to say I know very little about it, and am at a loss to understand our escaping from its ravages. I find that land in the highest state of cultivation is quite as liable to these pests as land not so well cared for. . . . I believe gas-lime to be the only practical cure for the maggot tribe that infest our Brussel Sprouts, Broccoli, and Cabbage tribe."

Information was also sent, on July 27th, from Ashford, Kent, by Mr. Hart, of Park Farm, Kingsnorth, that whole fields of Swedes were in course of being destroyed by a maggot at the root.

Likewise great destruction to Cabbage, by means of "white worms" at the root, was reported from Carnforth as taking place in that neighbourhood.

A maggot, which on examination proved to be Cabbage-root maggot, was also reported from Stanton-in-Peak, Bakewell, as infesting a crop of Swedes, and attacking, though in a lesser degree, common Turnips sown in the same field; and, going further north, Mr. Robert Service, Dumfries, mentions the attack as present in that neighbourhood early in the season.

Looking at the various localities given, the attack both to Cabbage and Turnip appears to have been prevalent over the country from Glasgow to the South Coast.

The following observations on attack of Cabbage and Turnip Maggot in North Britain also point to it being fostered by large application of farm manure, and checked by the application of lime, gas-lime, or artificial manure.

Mr. J. Spier, Newton, Glasgow, notes:—"I was greatly annoyed by the Turnip maggot in 1881. My crop was Golden Ball for early bunching for table use. They were manured with stable-dung in the drill, and sown in two rows on the drill.

"During June the maggot made such havoc among them as to reduce the available plants to about half a crop. That same season the maggot was tremendously bad on all Cabbage plants throughout the south-west of Scotland, many plots being almost destroyed. My own were worst on the heaviest-manured pieces."

Mr. George McKinlay, The Gardens, Kilconquhar, Fifeshire, notes the attack of the Cabbage-root maggot as almost certain to be troublesome to the grower if he is obliged to use fresh farm-yard manure. Such had been his own case in the past season; consequently the Cabbage and Cauliflower plot had to be replanted three times.

Owing to these attacks, when the sun shone out bright on a brake of Cauliflowers which had looked well up to this time, thirty to fifty would droop, and when pulled up were found to be attacked by maggot.

The remedy found most effective was some lime-shell put into a barrel of water, and allowed to remain forty-eight hours (when it was quite clean), and then applied to *each plant*, as by taking them straight forwards the pest is found to be stamped out.

In regard to my enquiries regarding prevention of Cabbage-root maggot, Mr. Boyd, Callendar Park Gardens, Falkirk, replied that where he had used gas-lime he had been free from attack, whilst at the other places where it had not been used the attack was very bad.

He mentions:—"In one instance I lost the whole crop of four rows of Cauliflower, and I am satisfied you are right about farm manure attracting the Cabbage Fly, as the four rows of Cauliflower were grown between the Asparagus beds, and in early spring the manure that covered the beds was raked off and dug in between them

and the Cauliflowers planted. Other three rows on another piece of ground, well-manured, seemed likely to go off altogether, and when I pulled up a plant I found the maggots in great quantities piercing the stem and roots. I at once applied a watering of guano (in the proportion of two handfuls of guano to a four-gallon can of water) to each plant; and whether it was the guano or not I cannot say, but after that not one went off, and they are remarkably fine.

"My other crops of Cabbage, Cauliflower (and also Carrots and Onions) are all clean, and the reason, I believe, is the ground being dressed with gas-lime.

"I am never without gas-lime, and I believe it to be one of the best friends farmers and gardeners have, both as a clearer out of pests and as a manure."

The notes of Mr. J. Whitton, from The Gardens, Coltness Wishaw, N.B., show little injury from Cabbage maggot on a system of manuring with only a small amount of stable manure and additions of artificial manure as required. He mentions the material applied is never manure in a rank condition; it is a mixture of short grass, &c., off lawns, and the straw and droppings from the carriage-horse stables. This is well mixed and rotted during the season, and requisite addition made by applying artificial manures to all crops during the growing time. "Generally we do not suffer so much by the Cabbage maggot as many of our neighbours, the only plants that suffer being the early lot of Cauliflowers and Brussels Sprouts, which are sown in heat, pricked out in frames, and finally planted with trowels. Plants sown in beds and drawn therefrom, and planted with a dibble, rarely suffer here. When the plants are fairly growing they get a dressing of guano, or are watered with liquid manure from the cow-house, and when the plants nearly meet in the rows they get a dressing of nitrate of soda.

"That is my usual treatment of the Brassicas, and we never fail in producing satisfactory crops of all sorts."

It will be noticed that one thread runs through almost all the above observations, and that is attack being the worst where farm manure (especially rank fresh manure) was used. Likewise, that where land had been treated beforehand with chemical dressing thoroughly obnoxious to the maggot, such as gas-lime, there was little or no attack.

There is no doubt that gross feeders like Cabbage and Turnips need plenty of farm manure, but it is badly wanted that some methods should be made out by which manure might be treated and applied so as not to attract crop flies.

The maggots of these flies live on vegetable matter for the most part, but also in rotting material, &c. Farm manure, which is in

great part of rotting vegetable matter, appears to attract the flies to lay, and the maggots from the eggs go on thence to the root. This appears to be the case, judging by the notes sent in by our own agriculturists during the last few years; also by continental observations.

Where there is fresh manure there are three points to bring attack: the smell to attract the flies, and the damp soft material for shelter, and food, as far as we see, for the young maggot.

It may be submitted whether in field cultivation of Cabbage a good dressing of lime given directly after the plants are put in would not be very serviceable. The plants are often merely carelessly set up in the hole, and a dab given on each side by the dibber, so that the root and the manure are both much exposed. If instead the workers were obliged to put in the plant properly, and a handful of lime was then thrown round each, there would not be nearly so much smelling surface exposed to attack, and the lime would give a surface thoroughly obnoxious to the Fly, as the maggots could not live in it.

It will be observed from the notes that dressings of gas-lime beforehand, or of lime, superphosphate, or anything suited to push on growth, but at the same time, as well turned by Mr. Glenny, "to make circumstances disagreeable to the flies," are what we want, and it would be very serviceable if in addition we had notes of how far watering manure in the heap with a weak solution of carbolic acid acts to prevent the heap being the head-quarters of maggots.

A watering of one part of carbolic acid in 100 or 200 parts of water, given once a fortnight to the outside of the heap,—say three times,—would cost little, and would not injure the manure, and might be exceeding likely to keep off Fly laying.

CARROT

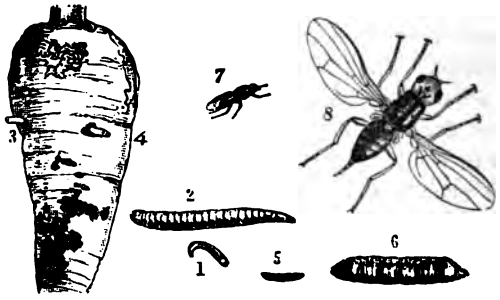
Carrot Aphis or Green Fly. *? A. papaveris*, Fab; *? Aphis carotæ*, Koch. (*A. subterranea*, Walker).

The following observations refer to attack of Carrot Green Fly on plants weakened by previous insect injury, mentioned on p. 18.

Mr. J. Speir notes, with regard to his Carrots at Newton Farm, near Glasgow, that "about the time the 'worm' (maggot of the Rust Fly) had exhausted itself, Green Fly began on the leaves, also on the west side, where the crop was weakened by the worms, and it gradually spread over the whole plot, reducing the leafage by at least an average of one-half.

"The last serious attack I had of this pest was in the wet summer of 1879, when the crop was scarcely half an average. How to combat it I have no idea, unless by repeated applications of soot or soot and gas-lime, but, from its speed in reproducing itself, it is with difficulty kept in check in fields of many acres in extent." *

Carrot Fly. *Psila Rosæ*, Fab.



PSILA ROSÆ.

Carrot Fly. 1, 2, 3, larva; 5, 6, pupa; 7, 8, Fly; all nat. size and mag.

The following information regarding prevention of worm in Carrots on the scale of farm treatment is contributed by Mr. J. Speir, Newton Farm, Glasgow:—

"This season my Carrots, of which I generally grow from fifteen to twenty acres, have been more damaged by the worm than usual. Part of them are after Potatoes and part after Oats, and (like the Parsnips) the greatest amount of damage is done after green crop. In the south-west of Scotland it is generally found that Carrots worm more after a green crop than after a grain crop.

"The reason I presume to be that in the former case (that of following green crops) the land is not so mellow and open, more approaching land which has been carted over in wet weather, which in nearly every case is sure to worm.

"The remainder of my Carrots, in another field about a mile off, low-lying and slightly sheltered *after Oats*, have hardly any Carrot worm.

"I find soot is nearly a preventive when duly applied, but that it does no good when the pest has made its appearance.

* Carrots are attacked by several kinds of Aphides. Amongst these the *A. papaveris* attacks the leaves. This, according to its condition, is almost black, black with greenish abdomen, or pale green. It frequents Chervil and similar weeds. The *A. carotæ* is green, and is found on flowers-stems of Carrot, also below ground.

It is hardly possible to suggest a remedy, except drenching with soft-soap, which is difficult in field growth; but turning the surface and dressing with fresh gas-lime in the autumn would be of use in cleaning the ground.

"I generally apply 10 cwt. of soot per acre, sown along the rows of plants about ten days after singling, for the earliest part of the crop, immediately after for those that are last done, as they are generally a good size before I get over them all, my Carrot-plot being large. I have usually only a small proportion spoiled, for the most part round the edge, or any pieces carted on in wet weather.

"This year the ten outside drills, adjoining seven potato drills, and then standing Wheat, were badly affected, whilst those having Mangold plants, in place of Potatoes and Wheat on the same side, were free. Any part sheltered or shaded by trees, fences, standing grain, or even by Potatoes, I find to suffer most.

"If the wind blows anything like constantly in one direction during the middle of July the Flies I find principally approach from the opposite direction, guided, I suspect, by the scent of the plants."

Probably it is the power of smell (which is possessed strongly by some insects) that attracts the "Rust" Fly to Carrot beds that have just been thinned, and consequently give off much scent from the bruised leafage, and which makes it so particularly desirable not to throw the soil more open than can be helped in the operation, or, where it is possible, to water well, so as to close all cracks against the entrance of the Fly.—Ed.

Mr. G. McKinlay, writing from the Gardens, Kilconquhar, Fifeshire, gives the following note of the good effect of sowing on holes filled with prepared soil where the land is not suitable for Carrot crops. He says:—

"I had the ground well manured and rough-dug by the 20th of November, being a strong advocate for autumn digging, so that the soil may get thoroughly pulverized by exposure to frost during winter. On the 23rd of April the ground was forked and raked for the reception of the seeds, which we sow at the above date. The following day a large quantity was sown, but before sowing a Potato-dibber was used for making holes four inches apart and seven inches deep. These were afterwards filled with leaf-mould, sand, and charcoal, a few seeds being deposited in each of the holes, and every other row was filled with pure sand.

"The seeds germinated satisfactorily, and looked well up to the 20th of June, when Carrot Fly-attack set in, first affecting those sown in the *garden soil proper* (so to distinguish it), which *disappeared* like snow in a thaw. Those that were sown in pure sand, and in the *mixture of sand, leaf-mould, and charcoal*, suffered a *little*, but, after receiving an application of sooty water and paraffin oil mixed, the pest did not make such rapid progress, and at present we are lifting some very fine Carrots.

"This crop has never thriven satisfactorily in the garden here

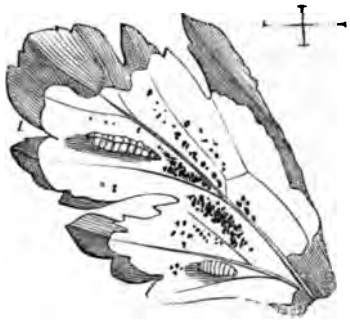
before, and I therefore am under the impression that gardeners who have any difficulty in growing Carrots should adopt the above method."

The following observation sent by Mr. Whitton, from The Gardens, Coltness, Lanarkshire, is a good illustration of the benefit of rotation of crops:—"This year, for experiment, I sowed Onions, Carrots, &c., in a small reserve garden we have, in which Cabbages and Peas only have grown for years. These were treated in the usual way with the others in the main garden (which is the dampest), and not a root was touched."

When once the ground gets infested by any of the various insect-pests it is no easy matter to get rid of them, so long as the plants on which they feed are cultivated.

CELERY.

Celery and Parsnip Fly. *Tephritis Onopordinis*, Curtis.



TEPHRITIS ONOPORDINIS, Curtis.

Celery Fly, magnified; line showing nat. size; maggot and pupa figured in blistered leaf.

One of the marked features of the crop attacks of 1888 was the great prevalence of injury from different kinds of Fly maggots. The method of attack of the Celery and Parsnip Leaf-miner is almost exactly like that of the Mangold leaf-grub, excepting that Mangold

Fly, as far as we know, always lays her eggs on the under surface of the leaf. From these eggs in either case the maggots hatch, and feed between the two sides of the leaf, thus causing first a blister-like appearance, afterwards a brown patch where the skin has been killed by the substance within being eaten away. The maggots turn in a few weeks to chrysalids in the leaf, or in the earth, from which the Fly comes out so soon in summer as to give time for a succession of broods. The Fly is of the size marked by the cross-lines opposite, and handsomely mottled with brown or ochry colour.

The Flies attack both Celery and Parsnip, but, as it is the former that usually suffers most, I have put the observations together under the head of Celery, with reference from heading of "Parsnip."

It will be noticed that at present scarcely any notes have been given of means of prevention, and the wide spread of the attack and great loss from it in market-gardening districts point to a cure being greatly wanted.

One of the earliest notes of the appearance of this Leaf-miner, which has been widely destructive in the past season, was from Mr. C. Whitehead, who, writing on July 10th from Barming House, near Maidstone, mentioned:—"The Celery and Parsnip Leaf-miner is doing immense damage here; hardly a plant has escaped."

Just about the same time the attack of this leaf-maggot was reported by Mr. J. Speir as having been unusually destructive to Parsnips on his land at Newton Farm, near Glasgow, the worst of the attack being on the part of the crop after Potatoes.

It is noted:—"About a week after I wrote to you last (July 10th) my Parsnips began to be affected with large brown spots on the leaves. These large spots look very like the browned parts on the leaves of the Mangolds, and I presume are caused in much the same way. One-half of the crop was dunged in the drill, each drill being 29 in. wide, with two rows on it 6 or 7 in. apart. The other half was manured on the flat and afterwards drilled.

"The former up to a month ago looked by far the best crop, but, owing to the browned leaves, is now far behind the other, as the damage on it is several times greater. The worst damaged lot was after Potatoes last year, the other after Oats."

On Sept. 26th it was further noted that the attack of the Parsnip-miner maggot had turned out most destructive. "Scarcely any season has ever passed without more or less damage being done (generally trifling, however), but this year my whole crop of three acres is worse than lost. At present scarcely a green blade is to be seen, and the land being bare Chickweed is growing rapidly, and, although the present (Sept. 6th) is scarcely the time to use Parsnips, I shall be

under the necessity of raising what crop there is, or the Chickweed will be polluting the whole place with seed.

"Next season, from the time the plants are singled, I propose dressing them with soot and gas-lime every two weeks or so, until about the end of July, by which time I think all danger should be past.

"Up to the present this disease has caused very little loss, the principal loss being caused by 'Rust' on the roots. Hitherto my usual remedy, or rather preventive, has been soot applied at the rate of 10 cwt. along the rows, which generally prevents both 'Rust' and 'Burnt leaves,' but not so this year. The soot was applied about July 10th." *

On October 15th Mr. J. Mathison wrote me from Addington Winslow, Bucks :—"It may be of some interest to you to know what a severe attack of the Celery Fly we have this year, but for which I can give no reason, seeing we have been almost exempt from it for some years.

"I never saw a more virulent attack ; I plant about 2000 Celery, and not one single plant is free, many of them very badly injured."

Mr. Turvill also noted on October 18th, from Alton, Hants, that his Celery had been all but spoiled by the Leaf-miners.

The Rev. J. H. White, writing from Weybread Vicarage, in the north of Suffolk, mentions that the chief attack of the season was that of the Celery Leaf-miner, which has been prevalent in every garden in the neighbourhood, and, as far as he can learn, has completely spoilt the crop.

Mr. Glenny, writing from Barking on Sept. 24th, notes :—"The Parsnip and Celery Fly made a grievous onslaught on our fields and gardens about the 14th inst. Large areas and small plots suffered alike, both being equally liable. One field of Parsnips, seven acres in extent, now looks miserable, as if a severe frost had struck the foliage. Naturally the roots will be checked, and a weaker yield will be the result."

At Detling, near Maidstone, Mr. R. Cooke notices that there was a slight attack of Celery Fly on putting out in the trenches: the first fortnight in September was a time of severe attack. He observes :—"Nothing but hand-picking seems to answer for the Celery Fly grub, and, to judge by the experience of this year, it should be attended t early in the season to prevent bad attack further on."

The above note of Mr. Cooke's is about the only suggestion of remedy sent in, and, though at first sight the hand-picking appears t o do as much harm as the maggot, yet (as noticed) it gets rid of an enormous amount of *coming* attack, and where Celery is grown

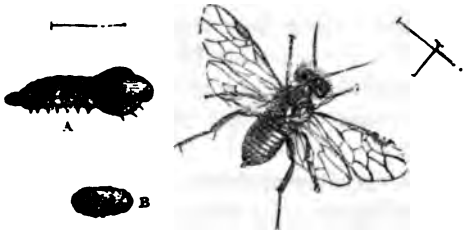
* For further notes on "Rust" see Carrot Fly, p. 18.

only as a garden crop probably is well worth while; but where the plant is a field crop in market-gardening districts, and the Flies consequently abound through the neighbourhood, it is quite another consideration.

A rapid healthy growth seems the main preventive of injury known at present, and any information as to dressings or sprinklings of prepared ashes on the leafage in the dew of the morning would be very serviceable.

CHERRY.

Slugworms; Larvæ of Cherry and Pear Sawfly. *Tenthredo* (*Selandria*) *cerasi*, Curtis.



TENTHREDO CERASI.

A, Slugworm, mag.; B, cocoon. Sawfly, magnified; lines showing nat. size.

The so-called "Slugworms" are often not recognised at first sight as caterpillars on account of the very peculiar appearance from which they take their name. They are really the caterpillars of the Cherry and Pear Sawfly, and do much damage to the leafage of several trees (amongst fruit trees, especially to that of Cherry, Plum, and Pear) by eating away all excepting some remains of the veins and skin of the under side of the leaf.

The Sawflies are of the common Sawfly shape, but the females are blackish, and the wings sometimes also blackish. They appear about July, and lay their eggs on the upper surface of the leaves. The caterpillars, which soon hateh from the eggs, are at first of the peculiar shape figured, much the largest near the head, and, after just their first appearance from the egg to their last change, of a black or bottle-green colour, and covered with a coat of slime or shiny moisture, which gives them much the appearance of a black slug, or, as it has been remarked, a lump of wet dirt let fall by a bird.

When full-grown they moult off their black slimy skins, and appear as buff or yellowish caterpillars, free from slime, and transversely wrinkled. The caterpillars go down into the ground, like those

of the Gooseberry and Apple Sawfly, and there spin cocoons, from which the Sawfly, unless double-brooded, comes up in the next season.

This attack is not often reported, but I was favoured with two communications regarding it during last season. One was from Mr. C. de L. Faunce de Laune, of Sharsted Court, Sittingbourne, mentioning the great damage that caterpillars of the above kind were then doing by eating the leaves of his young Cherry trees, leaving nothing but the fibre. The specimen enclosed was of considerable interest, for it arrived as a Leech or Slug-like grub, bottle-green in colour, slimy, and repulsive,—in fact, altogether a characteristic specimen of these injurious larvæ as commonly known. Shortly, however, it passed to the final moult, in which the Slugworms are not so often noticed; it slipped off its coat and appeared as a bright orange-coloured caterpillar, dry, wrinkled, and many-footed.

On Sept. 11th I was favoured by Mr. Vaughan Pendred, with specimens of a grub, by which he mentioned the Pear trees in his garden at Streatham had been attacked for three successive years, these being aptly described "as caterpillars more like small Leeches than anything else," and which eat the whole upper surface of the leaf.

Three years ago a very few appeared, but these were so few that no notice was taken of them. Last year they were more numerous, and this year (1883) they extended their ravages to Plum and Cherry trees.

The caterpillars are described as about three-eighths of an inch long, slimy and repulsive, black above, dark green below; syringing with salt and water had no effect upon them, neither had strong tobacco-water.

The most certain measure of prevention of attack of these Slugworms is (as with Gooseberry Sawfly) just to see how deep the cocoons are lying beneath the infested trees, and then skim off the surface to this depth, and have the infested soil destroyed. This is a thoroughly good preventive of future attack. If the rootlets are near the top still light pricking of the surface and removal will do good.

When the Sawflies are observed *on* the trees it is a good plan to shake them down when they are quiet, in the morning or evening, on to tarred boards or *tarred brown paper*.

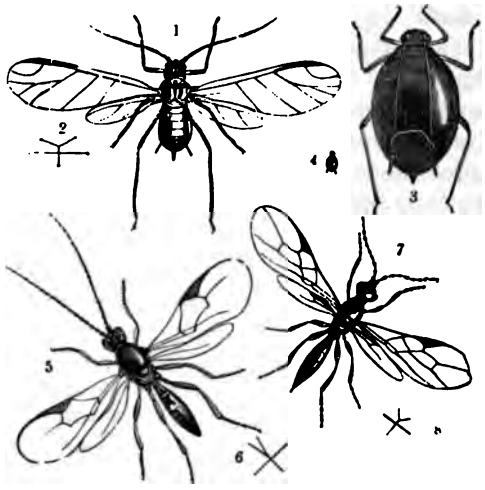
When the Slugworms themselves are at their work of destruction they may be got rid of to a great extent by dredging caustic lime on them, if the application is repeated a few times *at short intervals*. If it is done once only the Slugworm appears little injured, for it can moult off its coat with the dressing thereon, but it cannot keep repeating the operation; therefore repetition of the application kills it.

Solutions of hellebore, tobacco-water, and lime-water are variously

said to be useful, and not to be useful, in getting rid of these grubs, and probably the difference in success of the application depends very much on the above-mentioned power of the grub to moult its skin.

CORN AND GRASS.

Grain Aphis. *Aphis granaria*, Kirby, Curtis; *Siphonophora granaria*, Buckton.



APHIS GRANARIA.

1—4, winged and wingless Aphides, nat. size and mag. (3 and 4 discoloured from attack of Parasite Fly; 5, 6, *Aphidius avenæ*; 7, 8, *Ephedrus plagiator* (parasite flies), nat. size and mag.

The Grain Aphis is sometimes very injurious to Wheat, Barley, and Oats; in the present year the only note sent in was from Hagley, near Alcester, where a large proportion of a twenty-acre field of Wheat *after Clover layer* was infested by it.

Very little (if anything) appears to have been done at present towards getting a hold on the attacks of this Aphis, but, by putting together observation from different countries, there does not seem any reason why it might not be checked.

With regard to its winter history, it was observed by Dr. C. Thomas, late State Entomologist of Illinois, U.S.A., that when winter Wheat appeared above ground in the autumn the Aphides appeared on it. He says:—"Here they work upon the leaves and stalks singly

while the weather is not too cold, but when winter appears they move downwards towards the ground, some of them at least entering the soil and feeding upon the sap of the roots; at any rate I find the apterous ones at this time working upon the roots, but at the same time I find a winged individual above ground. I have also observed them heretofore at the root of the Wheat late in the winter, while snow was on the ground, and what somewhat surprised me, I found them busy at work under the snow, and the apterous (wingless) females bearing well-formed larvæ. I am therefore led to believe that in this latitude the species passes the winter *in other than the egg state.* This will also probably be found true wherever winter Wheat is grown."*

It is also stated by Dr. A. Fitch, the well-known Economic Entomologist, that "this species is an exception to the ordinary generation of Aphides in that it deposits no egg in the autumn, but hybernates beneath the snow."†

Now, if we turn to German observations, we find that this Aphis attacks Rye, three kinds of Wild Oat grass (*Avena*), two kinds of Brome grass, the Wild Barley grass, which is a most common weed by dry roadsides, Cocksfoot grass, the Soft Grass (*Holcus*), and Meadow Grass (*Poa*); in short it is known from the above or other observations to frequent all the common corn crops and many of the wild and cultivated grasses.

Looking at these points, and at the creatures having been found to winter on or at the roots of their food-plants, it appears together to account for—or at least suggest very strongly—why Corn Aphides should occur on Wheat after Clover layer, as they would be very likely to be sheltering amongst lumps of grass, and not be destroyed when the ley was broken up.

The habit of sheltering in wild grasses would quite account also for the appearance of the insect in spring or early summer on corn growing near such shelters.

It does not appear that when the Aphis is carrying on its attack in the early stage of the Wheat to the leaves or stems, and afterwards to the ears, any *remedy* can be brought to bear; but, as a means of prevention, probably treatment in breaking up of ley, dressings of lime, gas-lime, lime and salt, brushing, *burning rubbish*, &c., which are advised to clear these fruitful headquarters of our worst pests, such as Wireworm and Daddy Longlegs grub, would be very successful in clearing Aphides from the land before the next crop.

The various Aphides have very little power of removing them-

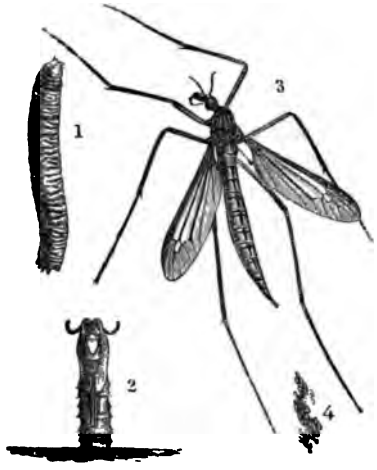
* 'Third Annual Report on Noxious and Beneficial Insects of the State of llinois,' by Dr. C. Thomas, pp. 53, 54.

† 'Trans. of New York State Agricultural Society,' xxii., 1863.

selves, and thorough disturbance of their shelters would be almost certainly fatal.

Similarly destroying headlands and breadths of wild grass would do good.

Daddy Longlegs. *Tipula oleracea*, Linn. (and other species).



TIPULA OLERACEA.
1, larva; 2, pupa-case standing in the ground; 3, Fly; 4, eggs.

Amongst the many bad crop attacks of the past season perhaps that of the Daddy Longlegs grubs was the most widely spread and the most lasting.

Early in the year enquiry began as to the nature of the grubs, which were then working at the crop roots, and these continued more or less until with autumn a vast appearance of the Flies gave reason to expect another attack of their grubs next spring.

The attack was reported from many places, and from as far north as Caithness in Scotland down to Brighton. It was injurious to Grass pastures, Oats, and Wheat; to Beans, Peas, and Turnips; likewise to Strawberries, and to lawns in public gardens or squares in London and Brighton.

More than one kind of *Tipula* was at work. The smaller, a yellower kind known as the Spotted Daddy Longlegs, which is sometimes considered as still more injurious than the common kind, was noticed by Mr. Fitch; and the kinds of grubs which were destructive in London may very probably have included those of the *Tipula quadrifaria*, which is stated by Curtis to be especially abundant in London gardens.

But whichever of these common kinds they may have been of, the above figure gives a good idea of the cylindrical, legless, tough, and grey and slaty grubs; and the treatment by which their ravages may be lessened is similar for them all.

It has long been known that the Flies choose damp spots, and shelter in grass or clover for laying, and in the following observations attack is again noted on marsh soil, on wet land, and especially *after Clover*.

The attack is noticed as having been least injurious where the land was well cultivated; and, where severe injury was going on, the same kind of application of fertilising dressings, which was found quite successful in carrying Oats through bad attack in 1882, has proved again successful. For special treatment in bad attack on large breadths of Cabbage land it has been found that hand-picking answered at a paying rate.

I wish also especially to draw attention to the observation of Daddy Longlegs grubs being found in *fold-yard manure*. The first of the following notes refer more especially to the smaller kind of Daddy Longlegs:—

At the end of April I received a communication from King's Heath, near Birmingham, regarding a grub then making great havoc in a large field of Spring Wheat after Beans, and Beans after Wheat. This grub, on examination, proved to be of one of the smaller kinds of Daddy Longlegs, probably the yellow-spotted kind (*Tipula maculosa*), which is, if possible, even more destructive than the common and somewhat larger kind. The grub was reported to be about one inch below the surface, and the heaviest roll used not to have the slightest effect upon it.

A little later Mr. E. A. Fitch wrote me from Maldon as follows:—

"You ask about *Tipula* larvæ in Essex. They are *very* bad; almost all the early Peas are ploughed up, and much of the Wheat has suffered from 'black grub,' which appears to be the general local name for these pests. The pretty kind, with a lot of yellow on the thorax, is, I believe, the chief culprit.

"I had eleven acres of White Sickle Peas, sown in November (Nov. 20th), which looked remarkably well until the March severe weather set in; then the grub attacked them, and they wasted terribly every day, until hardly a quarter plant was left. Hoeing did not mend matters, so at the end of March I again drilled the same Peas without ploughing the others up. After rolling and twice harrowing these came up a full plant, but were soon attacked, and there is not near half a plant of the two crops. The early ones are podding (a few almost fit to pick), the later are not in bloom, so altogether the field looks like coming to very little.

"The only two good early pieces about here sold last week at £15 per acre, the buyer to pick, cart, and do everything in fact. I should be glad if mine would come to £15 per acre, and this on the best field I have.

"The only remedy I can suggest is thorough and early hoeing; nothing else will touch the grubs, which *I believe work down deep in the dung* under the flag of the furrow during the day."

About May 10th I received information from Mr. A. Bannester, Barling, Chelmsford, that Daddy Longlegs grubs were infesting in great numbers a crop of White Peas on a fallow well tilled and on *marsh soil.*

Mr. G. Brown, Watten Mains, Caithness, N.B., mentions that farmers have suffered in all their crops from insect-attack during the past season. The chief characteristic of the attacks were the myriads of insects in the grub state, and the unequal nature of the damage done. Some localities suffered most severely, whilst others escaped with little apparent damage. He observes:—"*Tipula oleracea* has been very prevalent on clay soils, on corn after rough lea. My attention has been particularly directed to a field upon this farm (Watten Mains) which is very varied in the character of its soil, being clay, peat, and loam alternately. On the clay knolls this grub did considerable damage, which may be accounted for in this way:—The ordinary amount of cultivation necessary to bring the other parts of the field into good tilth was not sufficient to break down the clay into a fine mould. In consequence of this the seed was insufficiently covered up, and (the seed-bed being rough, growth was much retarded) then the grub, attacking the weak plants, almost destroyed the crop.

"Next on the peat, much of the ground was covered by rough grass, which cattle and sheep would not eat. These parts offered an excellent place for the deposit of eggs, and suffered in the spring from this cause, yet, owing to the vigorous growth which generally occurs on such soils, the damage done has been trifling.

"The loamy parts of the field escaped without damage, and have proved an excellent crop. The grub of this insect (Daddy Longlegs) has also done much damage to the young Turnip plants, and Peas also suffered."

From Levenshulme a note was also sent, with specimens accompanying, of the Daddy Longlegs grubs eating off the Broad Bean plants just at the surface of the ground, so that the plants fell down as if broken off accidentally.

The three following communications note bad attack *after Clover* ley, and mention is also made in them respectively of the large amount of grubs to be found in a given space; that the Rooks were not found to help in clearing the grubs; of fertilising dressings

restoring the growth of the crop; and the very important matter of Daddy Longlegs grubs being found in manure.

The first refers to specimens and information, with which I was favoured by the Hon. Cecil Parker, from the Eaton Estate Office, Eccleston, Cheshire. Mr. Parker mentioned:—"I sent grubs which were destroying a field of Beans here; the Beans were spring sown on land once plonghed *after Clover ley*.

"The grub attacks the Bean where it touches the ground, gnawing all round the plant, which is from two to three inches high. *Dozens of the grubs are found under a sod.* I may say that no Rooks have been noticed near the field."

Early in May information was asked (with specimens accompanying) by C. E. Bruce Foy, Esq., regarding a grub which was stated by the enquirer to be taking his spring Wheat at Mollington, Banbury, rapidly. He mentions:—"In the last eight days a field that was green all over has hardly a blade of Wheat to be seen. The field was *Clover last year*, ploughed up for winter Wheat, but, owing to the wet season, could not get it in before spring. The few grubs I send [thirty-three, Ed.] I took out of a drill-row, only scratching with my finger the length of two feet, so you may imagine in what quantities they abound. They lie in the ground at the depth of three-quarters to an inch. We have a large Rookery near, only no Rooks go near the field."

Mr. David Byrd, Spurston Hall, Tarporley, Cheshire, favours me with the following note relatively to carrying Oat crop over attack of Daddy Longlegs by fertilising applications:—

"This year we have a field of Oats of twenty acres (after Clover) sown on the last days of March. The Daddy Longlegs grubs attacked the crop to such a degree that fully half the crop appeared to be taken; the loss was estimated at eighteen bushels to the acre at 4s. per bushel, that is, a total of £72.

"On May 10th we began to apply the manure we had at hand—

Guano	1½ cwt.	the acre.
Kainite	1 ,,	,,
Superphosphate	1 ,,	,,
Salt	2 ,,	,,

at a cost of £28 10*s*., and labour £2 10*s*.; together £31.

"The harrows followed the manure drill twice, and a heavy Cambridge roll two or three times over the whole field.

"The crop is now cut, and all traces of the drill-rows are lost in the stubble. The roots have the appearance of having been planted, and many new shoots forced by the manure are plainly to be seen. These give a good head of corn, only not so ripe by ten or twelve days.

"The crop is estimated to be forty to forty-five bushels to the acre, so that we have the crop restored minus the cost of manures."

The following note from Mr. Byrd as to presence of Daddy Longlegs grubs in the crop from having been brought out in the manure is a confirmation from a direct eye-witness of what is probably often the case. He mentions:—"The Mangolds were attacked by the grub in the leaf, and, having sown Turnips with them, we took out the Mangolds, and have a very promising crop of Turnips, *although the Daddy Longlegs grub was there in numbers*, carried into the field with the *fold-yard manure and spread in the ridges.*"

Information was also sent in of Barley in Cornwall being destroyed by Daddy Longlegs grubs; and notes communicated by Mr. C. Whitehead of attack (which in this case was identified as that of the *Tipula oleracea*) occurring in Strawberry-beds near Maidstone. Likewise enquiries were received from north, south, and west of London, and also from Brighton, regarding attack of *Tipulæ* larvæ (Daddy Longlegs grubs) to grass in public gardens, squares, or park-lands, the above notes, taken altogether, showing the widespread prevalence of attack.

The following notes refer mainly to the great appearance of the Flies which took place in the autumn, with some observations as to handpicking:—

Mr. John Wilmot, of Derwent Lodge, Hounslow, notes:—"We have had an enormous number of the Crane Fly grubs this autumn on our Cabbage-seed beds. The plan we adopt is to send women with short sticks, and a small can to put them into, and go carefully along each row; and wherever a plant is eaten off there the grub is sure to be found.

"We have caught thousands of them this season in that way, and thus saved seven acres of Cabbage plants worth at least £40 per acre."

Mr. Edward Lingwood, writing from Thwaite, Stoneham, Suffolk, mentions:—"My greatest enemy, as regards Green crops, is a brown grub, which I am informed develops to the Daddy Longlegs. This works underground, and I have employed women to taken them out and destroy them."

Mr. D. Turvill, writing from West Worldham, Alton, Hants, on August 22nd, mentions the unusual amount of Daddy Longlegs in the district as a symptom of coming trouble. He notes:—"My Clovers are literally alive with them. I presume they are laying their progeny in our Clover to feed upon our young Wheats, when they are sown upon it by-and-bye. I shall not be surprised to hear of much thin Wheat later on."

Mr. T. Hart likewise mentioned, from Park Farm, Kingsnorth, Kent, regarding Daddy Longlegs, "that the Corn crops escaped the depredations of this pest, but the pastures suffered considerably.

Some meadows were literally strewn with dead tufts, which the sheep had pulled up in feeding, and about the beginning of September the *Tipulæ* Flies swarmed, rising at every step when disturbed in the pasture."

In my own observations of the habits of these Flies, I found all that has been said of their frequenting damp localities and long rough herbage confirmed, even to the point that where there were a few feet or yards of long neglected grass in otherwise sunny pasture, these parts were especially infested by pairing *Tipulæ*.

With regard to the exact spots for egg-laying, it appeared to me these were chosen with more care as to locality than is usually supposed, and I watched the female selecting a little morsel of dead leaves in a damp path, or a similar collection amongst grass to lay under. From this it occurs that the process of bush-harrowing grass-land, which is known to be serviceable as a prevention for Wireworm-attack, would be even more useful here. The dead leaves amongst the grass and decaying matter generally would thus be thoroughly disturbed, and much that was stirred up to sunshine and air would be too dry for egg-laying on, and likewise, from what happens in other cases, we might expect many of the eggs which had been laid amongst these rotting matters would be destroyed by being dried up when exposed.

I also tried very light sprinkling of gas-lime, about a month from the works, on a garden lawn which was infested by the Flies, and found it acted partially, but not entirely, in keeping them off. Likewise, though the application destroyed some of the grass-blades for a while, it was followed by good growth, and by extremely good growth of Clover, whilst the moss was also generally destroyed; this in itself removed much damp shelter for eggs.

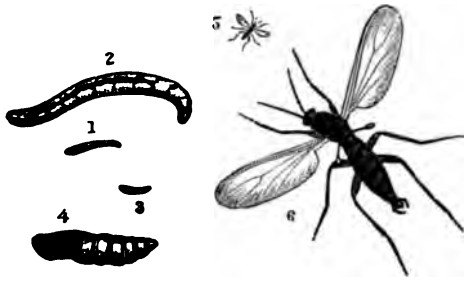
Further, as the males and females are remarkably different in shape, it was noticed that only a small or moderate proportion of the Flies were female, which may give hope for less injury than might be expected from the vast number of Flies that have appeared.

Young-Wheat Maggot. (? *Sciara fucata*).

Early in the year I was favoured with some notes from Dr. A. Voelcker, Consulting Chemist of the Royal Agricultural Society, relative to a small Fly-maggot, which was then attacking some of the experimental Wheat at Woburn.

I am not aware of the attack having been previously noticed, and further information regarding it would be very desirable; therefore, at my request, Dr. Voelcker permits me to give his observations. The

maggots were first sent me on Feb. 12th; they much resembled those of the *Sciara* figured, and, though they differed from the Daddy Long-



SCIARA FUCATA.

Maggot, chrysalis, and fly; all nat. size and magnified.

legs grubs in being very small, and also in being white, they were plainly, like the *Sciaræ*, very nearly allied to those common *Tipulæ;* and the following account by Mr. W. J. Malden, which was kindly forwarded to me by Dr. Voelcker shows their habits also to be very like those of the Daddy Longlegs grubs:—

"I have found a few more of the grubs which are attacking the Wheat, and have forwarded them. I daresay you will find that they have *worked into the lumps of dirt and Clover roots.* The fields most attacked in this district are after Clover lea, and last year the Clover-wheats were the only ones attacked, and, as the insects were found very much in the lumps of Clover which have been buried, it is likely that the Fly lays its eggs on the Clover, or (for that matter) on any green stuff convenient, and the grub comes to maturity in favourable seasons.

"There is no doubt that going off of Wheat at this time of year is almost always due to these grubs, as it always presents the same appearance, and I can remember it as long as I can remember anything. The *least pressure kills them*, so that heavy rollings would be the best way of killing them, provided the land would carry a roll or crusher; but that is in our case impossible at present, and, in fact, there is little land that would carry horses just now.

"I expect it is owing to these little beasts that Wheat always does best with a firm seed-bed. I think that rolling would answer for killing these better than killing Wireworms. A heavy roll will *kill* them, but it only retards to some extent the other insect from moving freely, though it is also good for pressing the soil well round the root, and letting it get fresh or firmer hold.

"We did not suffer from these insects during the frosty winters, two, three, and four years ago, but have done so during the last two;

so I suppose frost prevents them from maturing, or makes the ground too hard for them to travel through."

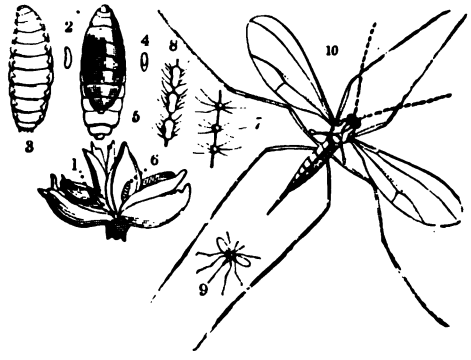
I am not able to identify the species of the two-winged Fly to which this maggot turns, with certainty; but by comparison with specimens from another locality, I believe it to be one of the largest kinds of *Sciara*, of which one species is figured above.

The grubs of these Flies live mainly on vegetable matter, and are to be found, amongst other places, at decayed roots of vegetables, and also in some instances amongst old perishing stems, and have been found feeding there on the remains of gnawed rubbish abandoned by other insects; but they are also to be found in putrid matter of various kinds, and in *dung*.

From these notes of their habits, and the observations given of the grubs being found in Wheat after Clover lea,—and "very much in the lumps of Clover which have been buried,"—they appear to be exceedingly like the Daddy Longlegs grubs in their habits and nature, excepting that they are so tender that they can be easily crushed. Probably the same measures of prevention would serve, and as the *Sciara* are particularly attracted to putrescence and perishing rubbish, thorough dressings of hot lime (or gas-lime in autumn, where the course of operations allowed of the application) could not fail to be of service.

Further notes as to this little Fly would be very desirable, in order to complete its history and identify the species.

Wheat Midge; Red Maggot. *Cecidomyia tritici*, Kirby.



CECIDOMYIA TRITICI.

1-6, larvæ, nat. size and magnified; 7 and 8, part of horns, magnified; 9 and 10, Wheat Midge, nat. size and mag.; infested floret.

I am favoured with the following notes regarding the Wheat Midge, by Mr. Russell Swanwick, from the Royal Agricultural College Farm, Cirencester:—

"On Sunday fortnight (June 17th), I first observed it, about three or four days after the Wheat-ears began to appear. It was then flying about, resting on the heads and depositing its eggs.

"The day before yesterday (July 1st), I examined some heads, and found a good many very small Wheat Midge grubs crawling about, chiefly inside *the outside chaff*, but very few actually attacking the grain, which was just beginning to form. There were a large number of Wheat Midges flying all about amongst the Wheat-stalks, but being rather early in the evening they had not mounted to the heads.

"I then searched the hedge-sides, amongst the grass, and found it as full of them as the Wheat. Wishing to know whether this was their hatching-place, or whether they came from an adjoining field, which is now Clover, but which had been Wheat the previous year, I went into this field, and at once observed a cloud of Midges rise when disturbed, which on closer inspection proved to be Wheat Midges. I should estimate them as ten times as numerous as in the Wheat.

"Here in all probability was their hatching-ground, and these Midges were about to make their flight to my adjoining field of Wheat. A number of old Wheat-chaff scales were visible on the ground, and the Clover-roots looked delightful cover for the chrysalids.

"In order to fortify our conclusion that this was the hatching-ground, we next examined a field of permanent grass, just ready for cutting, to see if there were any Midges there, but after a good deal of time spent we could not find more than one or two, probably blown over from the adjoining field.

"We examined some dung-heaps, thinking the hatching might be taking place there, but, though there were lots of other Midges, we could not make sure of a Wheat Midge.

"This certainly goes far to prove that it hatches wherever it falls at harvest-time.

"I have been in the habit of sowing my grass-seed with the Wheat crop, so as to keep my Barley free of grass, and hence obtain a better quality; it is possible that this custom may have rendered me more liable to the Wheat Midge attack than if the Wheat had been sown without seeds, and the stubble had been ploughed in. It would be very interesting if some evidence could be collected on this point of sowing seeds with Wheat, and the coincidence of worse attacks of Midge.

"I daresay there may be districts in which the true four-course system—of Barley, Seeds, Wheat, Roots—is strictly adhered to, and it would be a most valuable piece of information if the attacks of Midge were found to be less in those districts. What I fear is

that the Midge-grubs can feed and come to maturity in some other food than Wheat."

Prof. Wrightson also noted the prevalence of this pest on the land of the College of Agriculture, Downton. On July 20th, he mentioned, "Our Wheat is suffering fearfully from the 'Midge' this season, and I have given up all idea of a good crop. The little maggots are congregated to the number of twenty in one floret, and the grain is shrivelled up to nothing. The long continuence of cold and wet weather gives them every opportunity of carrying on their destructive work."

The yellow larvæ are mentioned by Mr. C. Whitehead as doing much harm in Wheat at Barming, near Maidstone. It is noted, "from 7 to 10 per cent. of the grains of corn are absent from the ears, and the larvæ are found in the chaff."

Mr. Hart, of Park Farm, Kingsnorth, Kent, mentions that he had a little red maggot in all his Wheat, though it was not to an injurious extent anywhere.

The details given in some of the above notes convey information which is very practically useful, particularly if looked at in connection with the most recent observations on the history of these Midges.

It will be noticed that at Cirencester a large number of Wheat Midges were observed flying about amongst the Wheat-stalks in the evening; also the grass at the hedge-sides proved to be as full of them as the Wheat; and further, that on examination of an adjoining field of Clover, which had been in Wheat the previous year, the Wheat Midges rose in great numbers on being disturbed. It is also noted that, after long examination of a field of permanent grass ready for cutting, not more than one or two Wheat Midges were found in it.

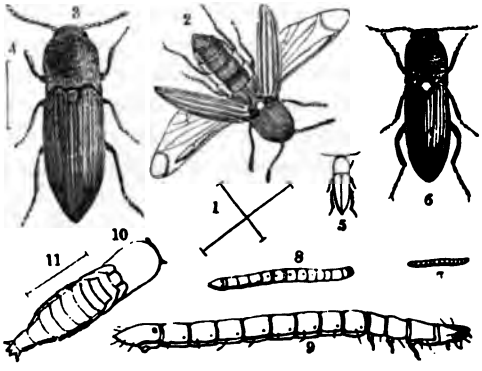
Now, looking shortly at the history of this Midge, as given partly in the German, partly in some of the Canadian and U.S.A. observations, we find that the female lays her eggs, not only on the flowering heads of Wheat, and sometimes those of Barley, Rye, Oats, but also on those of Couch-grass, or Twitch (*Triticum repens*); also that in every stage of its life it is very susceptible of effect from dryness or damp. It comes out in the evening to lay; damp weather at the season of laying suits it, and it has been noticed as frequenting low-lying fields, and also the neighbourhood of hedges.

Likewise observations are recorded of the Wheat Midge maggots (from which the Wheat Midges, male and female, presently developed) being found about the middle of June in clay from a field in which Wheat infested by Midges had been grown the previous year.

Here we have a definite observation of the Red Maggot wintering in the earth at the root of its food-plant, which accounts for it being

found (as above) in Clover after Wheat. The points of fondness for damp localities, and also presence in Couch-grass would conjecturally bear on the large numbers seen in the grass at the hedge-sides, and the very few (practically the absence) in the permanent grass fit for mowings; and the further point to which Mr. Swanwick draws attention of it being his practice to sow his grass-seeds with the Wheat, and therefore the stubble not being destroyed, would be (as we see above) likely to act very strongly in increasing amount of attack. The great point of prevention of this Red Maggot is to give it no winter shelter, which is *naturally* at the roots of the Corn crops or of Couch (and possibly some other) grasses; *artificially* in large chaff-heaps. The chaff-heaps and the rubbish and dust from the threshing-machine can be easily managed; and in the fields a great deal of the Red Maggot might be got rid of by taking the cultivator through the land, and collecting and burning the stubble-roots. Removal, or even rough mowing, or "skirming" of rough grass by hedge-sides before flowering time, would also do much good.

Click Beetles and Wireworms. *Elater* (*Agriotes*) *lineatus*; and other species.



ELATER LINEATUS, &c.

1 and 2, *E. lineatus*; 3 and 4, *E. obscurus*; 5 and 6, *E. sputator*, nat. size and mag.; 7, larva of *E. sputator?*; 8 and 9, larvæ of *E. lineatus*, nat. size and mag.; 10, pupa. Lines show nat. size.

The Report on Wireworm contributed in the previous year appears to leave little more to be said as to the methods of prevention or remedy of attack found to be practically serviceable; but in the following observations one or two points are continued then under experiment, and they refer, in two places, to the important matter of

Wireworm being found in, or apparently attracted by, manure; and likewise allude to field use of paraffin being possible and serviceable.

Mr. H. Marshall, of Poulton Priory, Fairford, confirms observations of the importance of a firm soil, which will prevent the Wireworms travelling, in the following note:—"Thorough cultivation and the use of a *really heavy* 'ring roller' in spring, whenever the land treads hollow, will, in my opinion, prove a thoroughly reliable protection against Wireworm."

He further observes relatively to methods of clearing Wireworm out of the land before putting in a crop:—"When I first farmed this land which I now hold (*viz.*, in the years 1860, 1861, and 1862) I suffered very much from Wireworm. In two fields particularly I had crops entirely swept off in succession. I tried all prescribed remedies (except Woad) without success, when it occurred to me that perhaps a thorough breaking up of the furrow before planting, in lieu of the ordinary method pursued in this country,—of simply dragging and harrowing it down,—might bring the food of the Wireworm, and in consequence the Wireworm itself, to the surface, where the Rook and the Plover might be trusted to deal with him. I tried the plan, and I have never had a *patch* cleared by Wireworm since.

"I fancy the cavities maintained by an unbroken furrow very possibly provide camping ground for other enemies besides Wireworm. The two fields were—one of twenty-five acres, of a naturally hollow soil, which had been a gorse common about twenty or thirty years before it came into my hands, and was drained by me four feet deep as soon as I took it into cultivation;—the other field is sixteen acres, a deepish loam on clay, and was a sour boggy pasture, drained to the same depth and broken up by me, the turf being ploughed down about twelve inches deep."

Mr. Edward Gordon, of Kelton Hill, Castle Douglas, Kirkcudbright, writes, in continuation of last year's observations:—"I think I told you that I had the Wireworms (to the number of several thousands), gathered from a portion of a field on which the crop had previously been invariably destroyed. The result is that this season the Oats are uncommonly good upon it, and no signs of Wireworm.

"I had treated this land with gas-lime without any apparent good, and then spread a heavy coating of farmyard manure on the stubble in the autumn, *which I now think fed the Wireworms*, as they came out very strong in the following spring."

Mr. Carrington, of Creighton, Uttoxeter, mentions that he frequently observes Wireworm in cattle droppings, and that he thinks the Rooks obtain a large supply of their insect-food from that source.

The following note refers to the application of paraffin on a working scale as a field remedy:—

Mr. James Kay, writing from the Bute Estate, Rothsay, N.B., mentions:—"Oats were a good deal wormed here in early spring, more especially in ground ploughed out of lea. . . . . I resolved to try the paraffin cure, and got several bags of sawdust, and after having it sprinkled with paraffin it was sown broadcast over the ground. Whether the worms were killed or not I cannot tell, but I am certain they must have been sickened with the fumes of the paraffin, as the crop seemed to regain vigour every day after the dressing."

Mr. J. R. Dunn, writing from Stone House, near Hawkhurst, Sussex, mentions that the land on his property, in a poor part of Sussex, is infested to such an extent that very frequently the whole of the corn crops are destroyed by these pests, notwithstanding the application of pressure by heavy Cambridge rollers and clod-crushers, &c., and treading by bullocks and sheep.

The following experiment as to the effect of Indian Rape—that is, mustard-cake—was kindly undertaken, at my request, by Mr. D. Sturdy, of Trigon, Wareham, to complete my own observations of the previous year (see Rep. 1882). . . . I had found that in the case of Wireworms fed in common rape-cake, and with no possibility of getting at any other food, the worms throve, and did not appear to need anything else to feed on; but, on the contrary, those fed in Indian Rape- (mustard) cake throve for awhile, and at the end of about a fortnight some were dead and all the rest dying. This was where the Wireworms had no other food, and to make out what would occur in fairly natural circumstances Mr. Sturdy carried on the experiment in Oats sown in boxes, so that there was choice of food, but still that we might be sure of all points noted. He writes:—

"Two boxes were sown with Oats in March, and when about two inches high one box was well larded with bits of the Currachee Indian Rape-cake you sent me: the bits were about the size of hazel-nuts. Twenty Wireworms were then put into the Oats with the Rape-cake and twenty into the Oats without, and so they were left. The Oats with the Rape-cake flourished exceedingly compared with those that had none, and the former (the Rape-cake Oats) were scarcely touched by the Wireworms, while the latter were a good deal injured. This day (May 1st, 1883) I turned out the Rape-box, hoping to find all the Wireworms *non est*, but instead I found everyone looking fat and well."

My own experiment had shown that the Wireworm in no way suffered from feeding on Rape-cake. Mr. Sturdy's shows that however bad the Mustard-cake may be as a compulsory diet, yet that where there is other food the Wireworm will not suffer in health from the presence of this special kind, and the observation certainly

confirms (if confirmation is needed) the view that Rape-cake acts by fertilising and helping the plant-growth, and also drawing away the Wireworms from the plant, but not by injuring the Wireworms.

BIRDS.

Depredations of Sparrows; Food of Birds generally, &c.*

During the past season I have received a good many communications relatively to encouragement or destruction of birds. Some correspondents take one view, some the opposite one of the subject; but I would submit that it is quite impossible to gain any well-based views on the matter from only a few observations of the apparent habits of solitary specimens of the living birds.

We need either to have observations of their habits in such numbers as will show surely what kind they are, and what they are doing, or to have observations taken of the contents of the crop *throughout the year*, as the diet may very probably be different at the different seasons.

With regard to the common Sparrow, I believe, from observations in some of our standard works (which are given after the following notes for comparison), also from other reports or personal observations, and also from the strongly expressed opinion of Mr. J. A. Lintner (State Entomologist for New York State, U.S.A.), who mentions, in his *remedies* for insect depredations, "Levy a war of extermination on that unmitigated nuisance, the English Sparrow";—for all these reasons I believe Mr. Lowe's observations to be hardly, if at all, overstated as to enormous damage being caused by the great increase of this special bird.

Mr. Ralph Lowe, writing from Sleaford, Lincolnshire, draws attention to the great increase in number of these birds, and mischief caused by them both from their attacks to the corn and by reason of their driving away other small birds which are serviceable insect-feeders. Mr. Lowe states:—

"The Sparrow has increased greatly during the last ten years; great packs of them swoop down on the Wheat fields, destroying more than they consume, spilling it over the ground. Every piece of Wheat which I saw this year has had more Corn destroyed by Sparrows than would pay one rent at least. . . . . If there are as many Sparrows in other parts of the country as there are in Lincolnshire most certainly one million pounds sterling would not repay the occupiers of land for the yearly loss sustained by the depredations of this

* As the above observations refer most to depredations of the Sparrow on Wheat, I have placed them under the heading of "Corn," &c., though the question of what amount of bird-presence is desirable refers to all our crops.

most quarrelsome pest, and they render, so far as I have been able to ascertain, not the very slightest service.*

"They prevent the increase of Swallows, and have literally driven all our soft-billed insect-eating birds from our gardens and orchards. The Flycatcher has gone; the Tree Creeper, the Peep, the Minor Warblers, most of which lived on *the eggs* of moths and butterflies, I have not this year seen a specimen of; whilst the grub in the Celery increases year by year, and the teeming thousands of Daddy Longlegs, and all kinds of moths and butterflies, give a pretty correct warning of what we may expect next year."

The presence of the insect-pests mentioned above depends also on other circumstances besides amount of bird-presence; but to return to the Sparrow question. Mr. R. Lowe gives the following observation from examination:—

"Seen following the plough, they were found to be feeding upon Turnip-seed that had not vegetated; seen upon the young Barley, they were found to be eating Red Clover and Trefoil-seed; examined to find what they were doing in Swede-Turnip field just bursting into flower for seed, it was discovered they were feeding on the young unopened buds; *one* bird had eaten a green caterpillar.

"In order to find if this bird really fed its young on Aphides," Mr. Lowe says, "I had a large quantity of young examined: not one, from those a day old to those ready to quit the nest, had eaten anything but Wheat. This was on a farmstead where Wheat or Wheat-straw was always accessible. In towns or on grass the case might be different; I cannot tell."

Mr. Lowe also mentions that he had one or more Sparrows killed every week for the whole year; for fifty weeks they ate Wheat; for two weeks they ate buds of fruit trees.

The observations on this bird in Yarrell's 'British Birds,' vol. i., state that "their young are fed for a time with soft fruits, young vegetables, and insects, particularly caterpillars"; likewise that, "as summer advances, and young birds of the year are able to follow the old ones, they become gregarious, flying in flocks together to the nearest field of Wheat as soon as the Corn has sufficiently hardened to enable them to pick it out; and here they are for a time in good quarters, but when the Corn is housed and the field gleaned, their supply being thus cut off, they return to the vicinity of houses to seek again the adventitious meal which the habitations of men are likely to afford them."

In the notes of Mr. A. Hepburn, quoted as those of a practical naturalist, in Meyer's 'British Birds and their Eggs,' it is mentioned:

* [They destroy some amount of caterpillars in nesting-time (*vide* Yarrell's 'History of British Birds,' and Meyer's 'British Birds and their Eggs,' &c.).—Ed.]

—"A long series of observations induces me to assert that with us they prefer insect-food, when it can be procured, but at the same time they like to vary their diet at every season with grain." It is likewise mentioned in the same passage, "Turnip-seed is chosen food." Likewise :—"In August, just when the grain begins to ripen, they assemble in vast flocks, and, if not carefully watched, will soon commit sad havoc in fields of Wheat, Oats, and Barley; indeed, the crops are never safe from their rapacity till carried into the yard."—'British Birds and their Eggs,' by H. L. Meyer, vol. iii., pp. 70, 71.

I give the above quotations as being from standard works of authority taking a fair view without bias to either side of this difficult subject, for in the general remarks sent by amateurs, neither agricultural nor ornithological, on habits of single specimens, there is sometimes reason to doubt whether the *right bird was observed*, and again the correctness of the observation has not been proved by examination *of the crop*.

I can bear witness myself to seeing a piece of Wheat near Isleworth so utterly ruined by legions of the Sparrows, which swarm amongst the neighbouring villas, that it was left uncut.

As far as my own opinion goes with regard to this special bird, there is great occasion to check its increase round villages, large farms, and in various places where, in consequence of there being a good supply of food and shelter, it has become a downright pest, and needs serious attention.

The general bearing of the question of bird-life on insect-life appears to be this: birds do a great deal of good by clearing off eggs, caterpillars, and insects; some birds take one kind more than others. Pheasants are fond of Wireworm; Titmice will clear some of the Gall-fly grubs out of the galls, and so on. *If bird-presence was diminished below the regular average we should suffer greatly.*

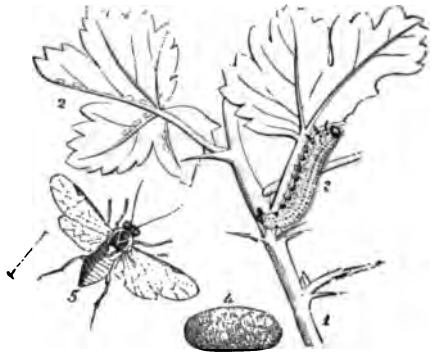
On the other hand, birds in their insect feeding destroy many of the kinds which are *carnivorous, or which live as parasite grubs within crop insects*, and in this way they do *not* help us, quite the contrary; and likewise, as very few birds are wholly insect-feeders, we have to consider what the *rest of their diet is* (as well as other practical bearings), and I believe that *if the birds were allowed to increase above the regular average we should certainly suffer.*

It has been objected that the words "average amount" or "disturbing the natural balance" are vague, but I believe that all practical agriculturists know well what is the common amount of different kinds of birds; and, as far as my own personal views go, I believe that it is very hazardous to disturb this (*unless there are very peculiar circumstances to warrant it*), either by broadcast destruction or by artificial measures of protection, such as putting up nesting boxes, &c., for insectivorous birds, as Starlings, Titmice, &c.

When birds, such as Sea Gulls, &c., come temporarily in great flocks on ploughed land, or pasture, or on trees, they should on no account be molested; they have come to clear off special attack, and when their work is done they will go. But this is a very different matter to keeping up a kind of poultry-yard of small birds which day by day have got to be fed.

GOOSEBERRY.

Gooseberry and Currant Sawfly. *Nematus Ribesii*, Curtis.



NEMATUS RIBESII.

Sawfly caterpillar; cocoon, mag. Sawfly, mag.; line showing nat. length.

The first of the following observations notes attack of Gooseberry caterpillars, and the difficulty of getting rid of the creatures when present; the others refer for the most part to the benefit of dressing with lime or gas-lime, or stirring or clearing away the surface-soil beneath. By these means (as shown in previous Reports) the caterpillars, which spend the winter in cocoons a little below the surface under the Gooseberry bushes, are killed or carried away, and thus the first batch of Sawflies, which would have developed from them in the spring and started a new attack, are got rid of.

Mr. Ellis Lord, writing from Netherton, near Heywood, Lancashire, mentions:—"Last year I was so troubled with them on my Gooseberry bushes as to destroy the crop; and, with the promise just now of plenty of fruit, these pests have made their appearance.

"We have syringed the bushes with plenty of water,—with water and petroleum oil even,—rinsing them about an hour after with plain water, and are trying soot under the trees. Enclosed is a specimen taken this evening, evidently as vigorous as ever."

At Watten, Caithness, Gooseberry Sawfly is noted by Mr. G Brown as having made its appearance in a good many localities. He mentions, as before, "that the principal cure used is hellebore, either infused in water and laid on the bushes by means of a common whitewash-brush, or dusted in the form of powder on the leafage; but the latter method is of no use if heavy rains follow, as it washes the tree clean of the powder before the caterpillar can get enough to annoy it.

"Year after year these attacks occur, and nothing in the shape of prevention is ever attempted; dressing with quick-lime, *and clearing away the earth beneath the bushes*, seems to be the best and surest measure."

Mr. T. Boyd mentions that at Callendar Park Gardens, Falkirk, he is now always free from Gooseberry caterpillar. He mentions:—"I dress over all my Gooseberry ground with gas-lime in early spring before forking over the soil, and have not seen one of these caterpillars for three years."

Mr. T. Hart, of Park Farm, Kingsnorth, Kent, writes as follows regarding the use of gas-lime to check Gooseberry grub:—"In a previous communication I believe I expressed doubts as to benefit derived from gas-lime. I must now correct that, for I am now satisfied that I have benefitted by the application of gas-lime between my bushes. Grubs there certainly have been, but, whilst they have almost stripped other bushes of their leaves, those on the dressed ground are little the worse for the attack."

Mr. Arthur Ward, writing from The Gardens, Stoke Edith, notes:—"Currants and Gooseberries out in the open garden have kept quite free from caterpillars (on the *open ground*); this I think was owing to the trees being dressed with lime early in spring. We have had very fine crops, and the flavour is excellent. Currant trees on the *wall*, which were not dressed with lime, were attacked. The attack commenced at the bottom of the tree on the leaves nearest the ground."

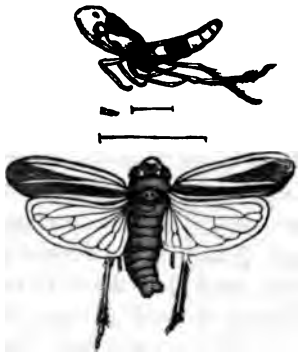
At The Gardens, Coltness, Lanarkshire, Mr. Whitton notes there was a sharp attack of Sawfly caterpillars on Gooseberry bushes, but it did not last so long as usual, as the cold wet weather in July probably checked them. A dressing of hellebore was given during the rainy weather, which speedily checked them.

HOP.

Hop Aphis. *Aphis* (*Phorodon*) *Humuli*, Schrank.

For these observations the reader is referred to the Appendix, as, for convenience of early distribution to contributors, the notes were printed before the rest of this Report, and consequently had to be paged separately.

Hop Cuckoo Fly, Frog Fly, or Jumper. *Euacanthus interruptus*, Linn.



EUACANTHUS INTERRUPTUS.

Hop Frog Fly, and early stage of the same, mag., and lines showing nat. size.

The following observations on Jumper, Cuckoo Fly, or Frog Fly, as it is variously called, seem to me to point to the yearly attack being begun by the young "Jumpers" coming up from the ground, or shelters in the ground of Hop-hills, where they had been recently hatched, or from crannies in old Hop-poles; and Mr. G. Turvill's note of the appearance of the Cuckoos in a Hop-ground which had been free from attack until poles from a badly-infested garden were brought to it, is very interesting.

Whether the autumn females live through the winter in nooks and crannies and lay in the spring, or whether, as I incline to think, eggs are deposited in bark or stems, or in other secure spots, is not yet proved; but, from the observations of these insects being found in a very minute state first early in the season, and also first at the base of the plant, it is probable something might be done to check their upward journey.

Paraffin (see p. 39), or any application thoroughly obnoxious to the insect, which might be so sprinkled in a dilute state on sawdust,

ashes, dry earth, or anything else which could be readily shovelled amongst the stems without doing them harm, would be a great deterrent.

Mr. D. Turvill, writing from West Worldham, Alton, Hants, mentions:—"Cuckoo has been very troublesome again this year. 'Catching' has been resorted to again by planters. The eggs are hatched in the ground, I believe, because the tiny things, no bigger than a Hop Louse, are observed *at the base of the plant* first. They change their skins very often, and when very small."

The following note confirms the view of the Jumpers coming up from the earth by the Hop:—

Miss M. Golding, writing from Ivy Hatch, Sevenoaks, on July 28th, notices an attack having begun on a Hop-garden there, "at present affecting the lower branches only." Some Hop leaves were enclosed to show what were believed to be the remains of the insects which had caused the attack, which proved to be cast skins of *Euacanthus* that is, "Cuckoos" or Jumpers, and one more advanced specimen.

Mr. G. Turvill, of East Worldham (also Alton, Hants), noted on May 28th, on inspecting some Hop-bines carefully, that they were attacked by Cuckoos in a microscopic stage. Further on (May 20th) he mentions:—"I also caught a few specimens of the Cuckoo Fly, apparently in two stages of moult, and submit the red-banded one has passed the second moult, as I find the very smallest (almost microscopic) of a dull ash-grey, without (to the naked eye) any bands; second larger, of much the same colour, but banded; and third, larger still, beautifully coloured and marked. The old cast skins remain whole and intact, adhering to the under side of the leaf. At present I have been unable to ascertain where and how the Cuckoo passes the winter, whether in the crevices and under the bark of the poles or in the ground; but the following fact has just come under my notice:—A grower had a plantation infested by 'Cuckoos'; it was grubbed, and the poles removed during the winter to another ground, which up to this time was free. It is now as badly troubled as the old garden."

Mr. Turvill further observes:—"From my own experience the attack is strongest in alternate years. In my own grounds they made a first appearance in 1876; a few solitary specimens in 1877 did slight damage; in 1878 they completely infested and destroyed about two acres in one garden; in 1879 they almost disappeared, and the crop was good (for a bad season); in 1880 they attacked the whole garden, scarcely a plant reached the top of the pole, and the crop was a failure; in 1881 'Cuckoo' was scarce, and the crop good; 1882 'Cuckoo' was numerous, weakening the plants, and was followed by 'Fly' and total destruction of crop; but, when the plant was hope-

lessly black and leaves fallen off, the 'Cuckoo' could not be found, and we were hoping he had removed; this year (1883) he has again appeared, but at present (May 30th) it looks as if the plant would be master.

"The injury done by them is by puncturing the bine; after they have left it the sap exudes in beads, and the plant is literally bled to death."

The appearance of the Jumper, in connection with the use of old poles, is worth further observation, as, if found to occur as a frequent thing, it might perhaps be stopped at a moderate cost, by different treatment of the poles, or more careful tarring of the ends.

"Strig" Fly Maggot. (Scientific name not ascertained at present.)

In the course of 1882 I received information from various observers regarding a maggot which did much harm by tunnelling passages in the stalk or strig of the Hop cones.

The damage was plainly to be seen, but I failed in any case to find the maggot within; this year, however, we have advanced so far as to find that the maggots are *certainly* those of some kind of *two-winged Fly*.

On August 31st Mr. W. J. Goodwin (who had communicated with me on the subject in 1882) reported from Winfield House, Cranch, near Sevenoaks, that there was again a bad attack of maggot in the strig of the Hops, and specimens of infested strigs were forwarded. These were tunnelled by the maggots, some of which were then at work in the strigs, and, on laying them on the table, the maggots shortly were very plainly to be seen, for they came out from the cones, and, joining head and tail, skipped (for their size) with tremendous leaps all about in the fashion of cheese-maggots. These maggots were white, very numerous, and certainly of some kind of two-winged Fly.

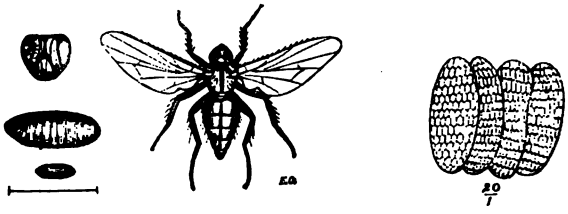
The only kind of two-winged Fly which I find mentioned as injuring the Hop by the minings of its maggot is the *Agromyza frontalis*, one of a genus of "small to very small" Flies, of which the maggots live generally by "mining in leaves or in the pith of plants, and which are all vegetable-feeders." But I do not find that mention is made of any kind of *Agromyza* maggots having the power of skipping about, which is a most marked characteristic of these strig maggots.

In turning to the genus, which includes the Cheese Maggots (*Piophila*), I find that there is one small kind which is noted as having "the habits of an *Agromyza*"; therefore I conjecture we may very likely find this maggot, which is so injurious to the Hop-cones, is the

larva of the little *Piophila pusilla*, and, judging by the great attraction decay has for many of these Flies, may very possibly be attracted in part by the richly-manured land. However this may be, I have so many specimens of the maggots carefully secured in the earth in which they buried themselves that I shall hope to be able to name the species in the coming season.

MANGOLD.

Mangold and Beet Fly. *Anthomyia Betæ*, **Curtis.**



ANTHOMYIA BETÆ.

Beet Fly and pupa, mag. and nat. size; head and eggs, mag.

During the past season the Mangold Leaf-maggot has been destructive at various places, but unfortunately scarcely any notes have been sent in of treatment to prevent or check it.

The great point appears to be to gain such a strong healthy growth as may carry the Mangold over attack; and in the following observation autumn cultivation is noted as having proved serviceable.

Mr. Jabez Turner, of Norman Cross, Peterborough, in reply to my enquiries, favoured me with information that his plan is to use a mixture of farmyard manure, *applied in the autumn* as soon after harvest as possible, and a fair dressing of superphosphate, &c., put on with the seed. He further notes:—"I have never suffered from Fly in a Mangold crop, as I think, if the plants are well fed and nourished, the growth is too strong for the enemy to do much damage.

"I may remark that the crop of Mangolds this season in the Fen district, where many are grown, is very fine, and the plants look remarkably healthy."

This communication, taken in connection with the following (which I am also kindly permitted to use) from the Hon. Cecil Parker, Eaton Estate Office, Eccleston, Cheshire, appear to me to suggest a good deal:—

Early in June I received, from Mr. Cecil Parker, a box containing maggots, together with Mangold leaves, with the information that they were specimens of the maggot then destroying Mangolds in Cheshire. Guano had been ordered to be applied along the drills, and was put at the rate of 8 cwt. per acre, but the weather, being dry at the time, it did no good, and up to September 6th it was still noted:—"The guano did no good; the maggots were in scores in the skins of the leaves, and in consequence there was at that time only about a sixth of what there ought to have been." Later on, however, "the Mangolds filled out considerably, and the crop was heavier than was expected."

On my request Mr. Parker procured me full details of the preparation of the land for the above Mangold crop of six acres, grown after Clover roots, which may be given shortly as—two ploughings, two scarifyings, three rollings, three harrowings, ridged twice; also the application of 8 cwt. of salt per acre, twenty loads of manure per acre, partly from the stud and partly from the farmyard, and, as above mentioned, 8 cwt. guano.

It will be noted that in both cases there was careful cultivation, but in the first the farm-yard manure was given in the autumn, as soon after harvest as possible.

It is nearly sure, from the careful turning over of the soil in Mr. Parker's treatment, that the Mangold Fly cannot have come up from chrysalids in the earth, and, looking at the fact of this class of Flies being attracted by manure, and the grubs being sometimes both manure and plant feeders, it appears worth observation whether there is *more* or *less* attack generally on land which has been *autumn* manured, and where consequently there is neither the rank state of the dung nor the smell from it which is attractive to some kinds of Flies nearly allied to the Mangold and Beet Fly.

But further, it appears from the observations of Mr. J. A. Lintner, State Entomologist of New York, U.S.A., given in his Report for 1882, that he has found three other kinds of Flies either *infesting* the leafage, or has reared them from maggots *in* the leafage of Beet, *besides the A. betæ*, which we know in this country.

One of these species is "very similar" to a kind (*Chortophila conformis*) which mines Burdock leaves in this country; another, hitherto undescribed, has been named *Chortophila betarum;* and the third, which *may have been merely infesting the Beet leaves*, was either the *A. floralis*, Fallen, which we know as feeding on Cabbage and Turnip roots, or the *Phorbia floccosa*, which, if not the same kind, is almost similar.

As yet we chiefly know the grubs of this Fly (the *A. floralis* or Radish Fly, see pp. 10—17) as Cabbage and Turnip root feeders, *and as*

manure maggots; and the observations are not complete as to it having been absolutely and certainly *reared* from maggots *in* the Beet leaves. But the observations of Mr. Lintner are well worth following up, and I should be greatly obliged to any agriculturists who, in the coming season, would send me pieces of infested Mangold or Beet leaves, by means of which I might rear the maggots to development; and we might thus learn whether we have various kinds of miners on these crops; whether they are kinds which frequent common weeds; and also whether any of them are of kinds which live also at roots or in manure.

Injury from Leaf-maggot to Mangolds is also mentioned at Admaston, Rugely, and West Worldham, Hants; and a note is given by Mr. David Byrd, Spurston Hall, Tarporley, that "the Mangolds were attacked by the grub in the leaf, and, having sown Turnips with them, we took out the Mangolds, and have a very promising crop of Turnips." In this case *fold-yard manure* had been used in preparing the ridges.

The settlement and spread of this Mangold maggot since 1879 has become such an important matter that I should also be particularly obliged if those who are good enough to communicate with me in the coming season would allow me to have notes of the kind of manure used and date of application, and also of the nature of the preceding crop.

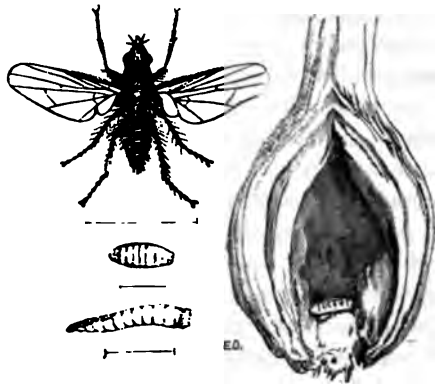
ONIONS.

Onion Fly. *Anthomyia ceparum*, Curtis.

Mrs. Carden notices the Onion Fly as having been most destructive this year in her garden at Endon, near Pershore, Onions and Shallots being both attacked. It is remarked:—"It commences its attack *not* on the leaves, but on the lowest part of the bulb; nothing seems to arrest its ravages." The ravages appear to have been also general in the neighbouring villages.

This matter of the *point* of attack is of much importance in arranging methods of prevention. Minute differences of description of species to which one specific name is given by various writers, likewise *various specific names* being given to what appears to be the *same species*, make it almost impossible to say in plain terms whether we have *two or more kinds of Onion Fly* in this country; but it is very plain that we have *another form of attack* besides that mentioned long ago by John Curtis in his 'Farm Insects.'

This first-observed method of attack was stated to begin by the Fly laying her eggs *on the leaves* of the Onion close to the surface of the earth, from which point the maggots made their way between the leaves into the lowest part of the Onion bulb.



ANTHOMYIA CEPARUM.

Onion Fly, maggot, and pupa; magnified. Pupa in stored Onion. Lines showing nat. size.

This was the form of attack ascribed by John Curtis to the *Anthomyia ceparum*, now named by Mr. R. H. Meade, to distinguish it clearly from *A. ceparum* of other writers, *Anthomyia* (*Phorbia*) *cepetorum*.

In the case of the Onion Fly, which I have repeatedly found attacking Onions when partially uncovered or shaken from the soil by hoeing, the injury began *not from above the bulb*, but below it or at the side. The maggot-entrance had distinctly been made at the base of the exposed bulb, or, if the whole bulb was not exposed, at the side.

The kind that caused this injury was different to the above, but the question of identity is so involved that, beyond saying that I gather it (from the result of minute enquiry and reference I have been favoured with) to have been the *A. platura* of Meigen (? *A. cilicura* of Rondani), I do not enter on the subject of the scientific name.

Various measures of treatment for Onion Fly have been given in previous Reports, but in personal experiment I find that any measures which will preserve the bulb from being exposed above ground, or which will bury it again up to the neck, if exposed in hoeing, &c., are very serviceable.

In garden cultivation earth may be thrown along the rows so that the Fly is perfectly unable *to get at the bulbs* to lay; and I have found treatment of this sort immediately followed by the eggs being laid at haphazard high on the leaves or dropped on the ground, where they perished, and the Onions consequently escaped attack.

Drawing the earth up over the bulbs, as in earthing up Peas, I have also found to answer well, and, though the first of these two plans is scarcely possible in field cultivation where the crop is broadcasted, it may be suggested, with regard to the second, whether, when the workers are thinning the crop, they might not at the same time draw the soil over the remaining bulbs.

The time when the young crop is thinned is the—or at least one of the—most critical periods, as the bruised, disturbed, plants attract the Fly, the roots are then most exposed, and also are often checked in the growth which might have carried them through attack.

The following information, sent by Mr. W. Harrison from Eskdale, near Carnforth, refers to a successful experiment with soot as a means of checking attack of Onion maggot when in progress :—

"The Onion-bed was about twenty feet in length. The maggots had commenced work from one end, and destroyed three-quarters of the crop. I applied the soot, and washed it well into the ground with a watering-can. I am glad to report that it had the desired effect, preserving the remainder of the Onions."

PARSNIPS.

For **Parsnip and Celery Fly,** *Tephritis Onopordinis*, see pp. 20, 21.

PEAR.

Pear Midge. *Cecidomyia nigra*, Meig.

On June 15th I was favoured by Lord Walsingham with specimens illustrative of injury to young Pears, caused by the maggots of a kind of small Fly or Gnat-midge which I am not aware of having been previously noticed as injurious to a serious extent in this country.

The specimens which were forwarded were of small abortive Pears gathered on one of Lord Walsingham's farms in Norfolk. The inside of these Pears were then in process of being eaten away by the small white legless maggots within, and information was sent accompanying that every Pear on the trees from which the samples of injury were taken was infested by them.

These maggots agreed, both in their habits and in the kind of injury they were causing, with those of the Black Gall Midge, the

Cecidomyia nigra of Meigen, and similarly had the power of skipping (like cheese maggots) in all directions, a faculty which they make use of in springing from the Pears in which they have fed, to the ground.

A little earlier in the year (on June 4th) an account of a similar attack, also not previously observed, was sent to me from Llanina, New Quay, South Wales, by Mr. C. R. Longcroft, who wrote as follows :—

"I have sent you some specimens of Marie Louise Pears, of which there was a splendid promise of a crop on two trees, but they are all attacked by grubs within. If you cut one open you will see the culprits.

"The same thing happened last year, causing the destruction of a crop, as well as in addition having destroyed a fine crop of Beaune Bachelier. I observe that the winter Pears have entirely escaped.

"I have not heard of a similar case in this neighbourhood, and, during my previous experience of many years, I never met with or heard of their appearance here. As it concerns fruit market-gardeners, as well as those who have Pear orchards, it may be deserving of notice."

If the attack is, as it appears to be, from the maggot of the Pear Midge, the history may be shortly given as follows :—The Pear Midge is a very small two-winged gnat fly, not more than a line long, of the same nature as the Wheat Midge (see fig. p. 84), but black or grey, not yellow. The females lay their eggs in the young blossom-buds of the Pear long before they have unfolded, by piercing through the petals or through the side of the bud with their long ovipositor.

The eggs have been found to be from one to twenty in number. They soon hatch and bore into the core of the forming fruit. There they live until they have gained their full size, and have hollowed out most of the inside of the Pear. The attacked fruit is consequently stunted in its growth, decays, and often cracks, and by this means exit is allowed to the maggots, which have the capacity of bending themselves together, and, with a spring, flicking themselves off to the ground, *where they bury* themselves. Sometimes, if the Pears have fallen without cracking so as to allow egress to the maggots, they will remain within for weeks, and then, when circumstances allow, will bury themselves. The further change to the chrysalis and midge takes place in the ground.*

Where attack is found established, of course nothing can be done to save the maggoty Pears, but by carefully looking over the trees, and, where the crop is in reach, picking off and destroying the little stunted fruit, and also by picking up and destroying the small fallen Pears, much future mischief may be prevented. Where the fruit

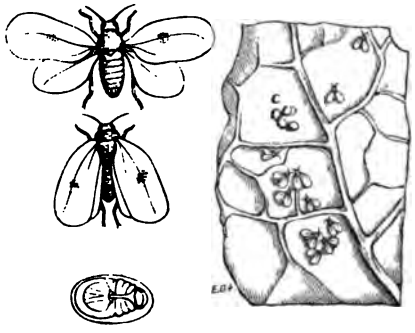
* See Kollar's 'Inj. Insects,' pp. 293—295.

cannot be reached, spreading a coat of quick-lime *on a dry day* beneath the tree and then slaking it would make much of the infested fruit fall, and the lime would be ready to destroy escaping maggots.

In orchards growing on grass-land a deal of infested fruit may be got rid of by having sheep on the ground; they will clear off various kinds of fruit with the contained insects, and I have known them specially partial to fallen Damsons.

Where the roots are not on the surface, it would be desirable to clear away a few inches of the top soil from under infested trees as soon as the stunted and maggoty Pears are down, and treat it in any way that would destroy the contained grubs.

Moth Blight, Snowy Fly, or Powdered Wing. *Aleyrodes Phillyreæ*, Signoret, and other species.



ALEYRODES PROLETELLA, Linn.

Snowy Fly and early stage on leaf, twice nat. size. Fly and under side of pupa, much magnified.

The kind of Snowy Fly which is most important practically is that figured above, which infests various sorts of Cabbage. It may be found more or less all the year round, and sometimes occurs in great numbers, which rise like a quantity of minute snow-flakes on any disturbance of the plants they infest. These "Moth blights," as they are sometimes called, lay their eggs in patches on the Cabbage leaves. The larvæ or maggots, which hatch from these eggs, are much like very small white or yellowish scales in appearance, and sticking fast to the leafage, to which they do much harm by drawing away the juices with their suckers.

The various kinds of *Aleyrodes* (see observations on *Aleyrodes* by Dr. Signoret) resemble each other in being whitish, and covered with a kind of mealy powder, from which they take their name, and which is to be found like white dust on the leaves they frequent. Their

white wings are sometimes spotted (see figure), and the bodies are sometimes reddish or more or less spotted with black.

In the larval state they vary both in colour and in sometimes being smooth, sometimes sprinkled over with hairs, tubes, &c.

"They are to be found under leaves and in situations which are sheltered and rather damp; they are less common during great heat than in spring or autumn, but may be found in all stages during winter. In the perfect state they may be found in crannies in bark, or in the ground, or even under leaves; in the condition of eggs, larvæ, or pupæ, beneath the leaves which support them, as Arbutus, Chelidonium, Alaternus, and Cabbages."*

The common Cabbage "Snowy Fly" is represented above as a general guide to the appearance of those of which the following observations have been given, which are less frequently met with :—

On Sept. 12th information was sent me by Mr. T. B. Woodward from Hardwick Bank, Tewkesbury, of a blight which had appeared in his own and neighbouring gardens during the previous fortnight in the shape of myriads of tiny White Moths, about the size of a flea or gnat, and which were then taking to the Espalier Pears, under the leaves of which they were already setting up attack of their larvæ.

On Sept. 17th further information was given that the Moth-blights were in great numbers on all the Espalier Pears in a large garden, but had not touched any other kind of plant, and a few days later they were mentioned as having appeared in a garden about a mile off; likewise that on a Privet bush, which had been nearly smothered by them, they appeared partly dead, but those on the wall Pear trees were as lively as ever.

This attack is of special interest, as I do not find either by enquiry or reference that any species had previously been noticed as specially infesting the Pear.

A little earlier in the year, on August 18th, I was favoured, by Mr. C. Magniac, M.P., with specimens of another kind, which was then appearing in great numbers in his garden at Colworth, Bedford.

This species of "Snowy Fly" or "Powdered Wing" (which was infesting Arbutus of some kind or Phillyrea) in the garden, proved to be *Aleyrodes Phillyreæ*, which is distinguishable from some other kinds by the small scale-like grubs being set over with short tubes or tube-like growths.

When the myriads in which these little Snowy Flies appear are observed taking up their quarters on trees or shrubs, like the Pear or Arbutus mentioned above, much might be done to get rid of them by a thorough drenching, syringing applied by the garden-engine, or (if

* See Monograph on *Aleyrodes*, by Dr. Signoret. Published in 'Annales de la Société Entomologique de France.'

it should be where there is a force of water on from waterworks) by the garden-hose used with a spreader. The Snowy Flies rise like a cloud on disturbance, and only fly a very little way, and thus many could be fairly drenched down on to the ground, and a sprinkling of lime or even ashes or earth above the wet surface would prevent the revival of such minute delicate forms. If soft-soap and water were syringed at the leafage this would also do much good.

In the case of deciduous trees, like Pears, clearing away the fallen leafage in autumn and burning it would be very desirable. Stirring the top soil well, and putting a good dressing of quick-lime on the surface, would do good, and also brushing the bark with any mixture, or simply with lime-wash, so as to clear out or stifle any of the Flies that might be harbouring in crannies.

Note.—The following observations refer to the benefit to Pears or other standard or wall-fruit trees from various methods of applications of lime, not only such as the whitewash and dusting often used, but proper cementing of walls, &c., so as to remove or destroy dead or live points of shelter and also some amount of the sheltering pests.

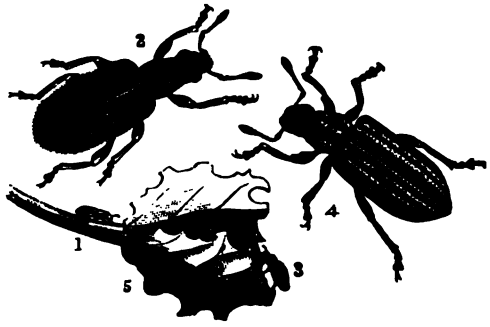
The following note is from Mr. G. Brown, of Watten Mains, Caithness. He says :—"Pear trees have suffered a good deal during the past years from the attacks of a caterpillar, which affected the leaves in such a way that they rolled up and gradually shrivelled and died.

"During the spring of this year these trees were taken out from the wall on which they were trained to admit of it being cemented and whitewashed. During this operation the trees received a good dose of the lime-wash, which has cleared off the insects completely, as the foliage has been during the summer quite fresh, luxuriant, and a beautiful green."

Mr. D. Scott, Ballinacourte, Tipperary, notes :—"I remark that fruit trees in the garden here are more free from attack since I recommended dusting them in November with quick-lime ; it burns off the moss, removing all refuge for vermin."

PEAS.

Pea and Clover Weevils. *Sitona lineata*, Linn. (and other species).



SITONA CRINITA AND S. LINEATA.
1 and 2, *S. crinita;* 3 and 4, *S. lineata*, nat. size and mag.; 5, leaf notched by Weevils.

In the course of the spring and summer of 1882 the long-needed observations of where the maggots of the *Sitona lineata* and *S. puncticollis* (that is to say, of two kinds of Weevils which often cause great injury to Peas, Beans, and Clover) feed and turn to a chrysalis state were made respectively by Mr. T. H. Hart, of Park Farm, Kingsnorth, Kent, and Mr. R. W. Christy, Boynton Hall, near Chelmsford, and were given, up to the time of preparation for publication, in the 'Report of Injurious Insects for 1882.'

The following observations by Mr. R. W. Christy complete his observations up to the same time in the season of the year in 1883, in which he began them in 1882, and I prefix a few lines of abstract of the first part of his observations.

In March, 1882, he found the Weevil grubs* present at and much injuring the roots of Clover; these (*Sitona*) grubs turned to chrysalids about the end of May, from which the first Weevils came up about June 20th. The Weevils were exceedingly numerous and injurious in the usual way, by gnawing the roots of leguminous plants, and towards the end of November the new generation of grubs from the eggs of these multitudes of Weevils was working at the roots of the Clover.

Here the observations in the Report of 1882 stopped. Mr. Christy now continues:—

"On Nov. 23rd I examined great numbers of Clover roots, and

* This attack was of *Sitona puncticollis*, which is very like the common Pea Weevil, *S. lineata*, excepting being a little larger, and having a few whitish spots on the fore part of the body near the head, whence the name *puncti-collis*. The maggots of these two kinds of Weevils are about a quarter of an inch long, legless, wrinkled, and whitish, with a brown or ochre-coloured head, furnished with jaws, the chrysalis like the beetle in shape, with the forming limbs folded beneath it.

was surprised to find numbers of *Sitona* larvæ *in all stages of growth*, some evidently just hatched, others nearly or quite full-grown. This field was noticed in harvest-time to be swarming with Clover-weevils, the platform of the reaper being literally covered with them when the *Barley was being cut.*"

"Dec. 28th, examined several plants of Clover, and in each case found larvæ at the roots.

"Jan. 11th (1883), made a general examination of the Clover fields. We have over fifty acres of Red Clover this year, grown after very different crops and under different circumstances, all more or less affected. In fifteen acres of Clover, grown with Barley, the Weevils were numerous; in fifteen acres, grown with Wheat after summer's fallow, they are not quite so abundant. . . . . In no case have I found any pupæ, although full-grown larvæ occur frequently.

"I found several Weevils hybernating in the outside of a Clover-seed stack, and have no doubt they do so in large quantities, as I shook several out of a small bunch of heads."

Looking at the series of observations together there is no doubt that it is these legions of Weevils, many of which are noticed on the platforms of the reapers or on the floors of the waggons, that are the starters of the next attack.

Some of these, as noted below, go into winter quarters down the hollow stubble straws, and in the following spring they come out to feed on the leaves of the Peas or Clover, &c., and to lay eggs and continue their species; but many begin their egg-laying at once.

Mr. Christy noted before that on October 21st the Clover roots were free; now, as observation went on, he found about a month later many of the maggots, some of them just hatched, and these maggots were to be found throughout the winter.

The two following observations also confirm the point of the enormous number of Weevils to be seen at harvest-time, and the fact of the creatures sheltering for hybernation down the stubble straws,—

Mr. D. Turvill, writing of the vast number of these pests to be seen on his land at West Worldham, Alton, Hants, mentions:—"I have been busy carting Peas; these were swarming with Weevils, lying an inch thick in the bed of the waggons, and numbering millions. An inspection of the barn now shows myriads crawling out of the Peas and covering everything, 'as thick as the hairs on a hog's back.'"

On Sept. 25th the Rev. J. C. Clutterbuck, of Long Wittenham Vicarage, Abingdon, mentioned he had just heard that the *Sitona lineata* had appeared in the stubble, taking refuge *in the open straws* above the joints, and threatening the early-sown *Trifolium incarnatum*.

The above notes, taken together, give a pretty fair idea of the history of these various Weevils through the year. It is scarcely

possible to give, for practical purposes, observations of one species distinct from the other (any more than of the different common kinds of Turnip Flea-beetle), as several kinds appear to feed almost indiscriminately on Peas, Beans, or Clover; sometimes as Weevils on the leafage (as we have long known); and sometimes (as we have learnt in the last two years) in their first stage as maggots at the root.

One great point of prevention would be to keep the autumn Weevils from taking up their quarters in stubble, either for winter shelter down the straws, or for egg-laying by going down in the earth amongst the Clover roots.

Relatively to the first habit, the Rev. J. C. Clutterbuck, who devoted especial attention to this point, mentioned, as noted before:—"We traced the sometimes total loss of *Trifolium* to this source, as we found the insects in the top joint of the stubble, amongst which we generally drilled the *Trifolium incarnatum* without ploughing. We lightly skimmed the stubble, and so deprived the Weevil of its habitat and refuge; and we believe we abated the evil."

With regard to treatment that might act in making the ground obnoxious to the Weevil and favourable to the support of the attacked Clover, Peas, or Beans, as by dressings of lime, gas-lime, or other applications or treatment generally, any practical information would be thankfully received.

PINE.

Cottony Pine Aphis. *Schizoneura fuliginosa*, Buckton.

Mr. Angus McIntosh, writing from Llanerch, Llanelly, S. Wales, gives a note of the effect of Paris green (arsenite of copper) in getting rid of *Schizoneura fuliginosa* on infested Pines.

[This Aphis is found on *P. Austriaca* and also on *P. sylvestris*. It may be generally described as black, hairy, and somewhat coated with a mealy secretion when fully developed; with a greyish wool rather than hair in the preceding stage, when it has only wing-cases. It forms white cottony tufts in the axils of the leaves. See 'British Aphides,' by G. B. Buckton, F.R.S., vol. iii., p. 96.—Ed.]

Mr. McIntosh says:—"I put two tablespoonfuls of the green into a bucket of water and sprinkled it rather heavily over the Pines with a watering-can. The application soon killed the insect, but it nearly killed some of the Pines! The dose was too strong. A little less than a tablespoonful of 'green' to a bucket of water would, I fancy,

be as much as the soft unripe shoots and foliage of the Pines could bear, and would, I have no doubt, kill the insect."

The application of Paris green was found to be so serviceable in checking attack of the Colorado Potato Beetle, when the Potato crop was threatened in North America, that its use has since been worked forward in detail, both as to the method and quantity, &c., by the U.S.A. State Entomologists; and I believe it might be so beneficially used in this country for many kinds of attack on leafage, that I give the following information from the observations on this subject in the 'Annual Report of the State Entomologist for New York,' issued October, 1883.

The precise amount of Paris green which has often been applied without injury to many plants is a tablespoonful (that is, about an ounce and a half) in a pailful of water (that is, about four gallons).

It is more safely applied by syringing than as a dry powder, as, being arsenite of copper, it is of a highly poisonous nature, and without great care the powder, in the dry state in which it may be inhaled, would be excessively prejudicial to the health of the operator.

With regard to method of application, for a few plants it is stated "no other appliances are needed than a small pail and a brush-broom. With the latter in the right hand the water at each dipping may be sufficiently stirred to hold the green in proper suspension, and the liquor shaken over the plants. When a larger amount of the liquid is necessary it may be applied with an ordinary watering-pot, provided with a more finely-perforated rose than that which commonly accompanies it, which can be made by the tinman. The contents of the pot will require constant stirring with a stick to prevent the settlement of the poison."

For application on a still larger scale larger cans are used, which are so arranged that they can be strapped on the back. . . . . One of these is described as a "can capable of holding about eight gallons of liquid, and so formed as to rest easily on the back, to which it is fastened knapsack-fashion by adjustable straps. To the lower part of the can are attached two rubber tubes, each furnished with a rose or sprinkler. The tubes are held respectively in the right or left hand of the bearer, and thus the fluid may be rapidly applied to a field crop.* For trees it may be applied by a force-pump (also by a garden-engine) with various adaptations."

The material is purchasable per ton in England under the name of "Scheele's Green." It is procurable at 6d. a pound, with large reduction on taking a quantity.

From the poisonous nature of this compound I would not take

* See 'First Annual Report on the Injurious and other Insects of the State of New York,' by J. A. Lentner, State Entomologist.

upon myself the responsibility of advising its application in a dry powder, which has risk for the operator; or to food crops, although careful analysis appears to show the small quantity of arsenic applied is much below what can do harm in the ground; but stirred into water for such purposes as sprinkling in Pine nurseries, or for application to leafage of infested trees generally, &c., it might be very useful.

Pine Beetle. *Hylurgus Piniperda*, Curtis.

HYLURGUS PINIPERDA.

1 and 2, Pine shoots pierced by Beetles in section; 3, 4, Pine Beetle, nat. size and mag.; *e e*, jaws, with chin and feelers between, much magnified.

Mr. Robert Coupar, Colenden, Scone, together with observations in confirmation of the notes of habits and methods of prevention of the Pine Beetle, which have been previously given by himself and other observers in these Reports, contributed the following notes on prevention:—

"When young plantations of about six to twelve years old are attacked they may be gone over, say in June or July, and the infested shoots picked off; but (as these Beetles are very wary) at a touch to the branch they back out of their tunnels and fall to the ground. Therefore, after collecting attacked shoots into a basket, the work may prove to have been to no purpose, and on arrival at the end of your journey you may find the shoots quite clear of Beetles, these having all escaped. The most serviceable (and a quite practicable) way is to set a quantity of 'Beetle-traps,' which are laid about in the plantation, and are thus arranged:—Cut in the autumn a quantity of young Scots Pine tops (thinning off all the branches, which makes them more convenient to handle). Lay these props about in the young plantations, or up against the lower part of the standing trees, so that the under side *will not rest on the ground*, because the Beetles do not lay their eggs where the trees are lying amongst damp or wet.

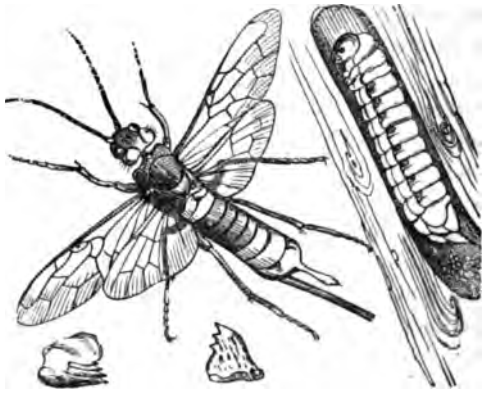
"When the time for egg-laying comes the parent Beetles select these pieces of Pine, and by collecting them again (say in the month of June or sometimes earlier) you will have under the bark a great number of these destructive pests.

"This is a most practicable way, as it answers for plantations of all ages. As I stated before, I have found in old plantations (from 60 to 100 years of age and over) that, when large branches decline and growth becomes languid, then these Beetles select them to lay their eggs in, as also in decaying standing trees. Again, no decaying trees should be allowed to lie, and thinnings should be cleared up as soon as possible."

Mr. Coupar noted in May, with regard to a large quantity of young Scots Pine, which had been cut down in the course of thinning, that at the time of writing the Pine Beetles were very busy indeed laying their eggs. These Pines had been cut down in the previous January, and the note confirms previous observation of these Beetles choosing, for egg-laying, trees which have been only lately felled, and which consequently have neither the full flow of sap of the living trees nor yet have laid long enough for the inner bark to be exhausted.

Note.—For history and means of prevention of ravages of the Pine Beetle see the observations contributed by foresters given in previous Yearly Reports.

Giant Sirex, "Timber Wasp." *Sirex gigas*, Linn.



SIREX GIGAS.
Female *Sirex*, and larva.

The splendid insect figured above is not usually credited with doing much mischief in England, but from my own observation I incline to think that this "Timber Wasp," as it is called in Germany, as well

as a smaller kind, the *Sirex Juvencus*, are more often at work than is supposed.

On September 19th a fine specimen of the female of *S. pigeo* was forwarded to me by Mr. Craig from the Bradford Estate Office, near Shifnal, with an enquiry as to whether it was injurious to Larch trees, as it seemed very fond of Larch wood, and had been seen with its ovipositor stuck into the bark of Larch trees, where it was supposed to be placing its eggs.

The female of the *Sirex pigeo* is black, banded with yellow, and lays her eggs by means of the strong ovipositor beneath the blunt point to the tail figured in the sketch of the insect in the act of flying. The eggs are thus inserted in solid wood, and, like many other kinds of timber insects, the female appears to prefer sickly trees where there is no rapid flow of sap, or felled trunks to attack.

The maggots are cylindrical and whitish, and the head is furnished with strong jaws, by means of which they gnaw their way forward and form large borings in various kinds of Pine wood, thus wasting much of what would otherwise have been serviceable timber.

These maggots feed for about seven weeks, and may then go through their changes to the chrysalis and to the perfect insect in about a month, or the appearance of the insect from the attacked wood may not take place for years.

Where these large maggots are found in felled Pine it is desirable to have the trunk sawed up at once, so as to get rid of the centre of attack, as, where there are a few observable, it is very likely there will be many more in that special trunk; but as yet attack of this insect to a seriously injurious amount does not seem to have been noticed in this country.

POPLAR.

Goat Moth. *Cossus ligniperda*, Fab.

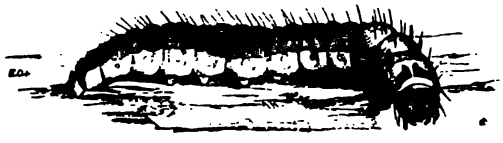
On May 15th Mr. Angus McIntosh forwarded me from Llanerch, Llanelly, S. Wales, a piece of Poplar wood containing two caterpillars of the Goat Moth, with the mention that in thinning some Poplars and Willows which grew on a very wet piece of ground it was noticed that several trees which were cut down had been bored into by the grubs. These had made their way into the wood at the lower part of the stems of the trees below the surface of the ground, and had bored upwards. About a dozen of the caterpillars were in the Poplar from which the specimens were taken, and the tree was nearly dead.

The habit of the Goat Moth is to lay her eggs at the lowest part of the tree, and a badly infested tree may often be known by the wood chips thrown out from the caterpillar workings, which lie on the

COSSUS LIGNIPERDA.
Goat Moth and chrysalis.*

ground close to the trunk, as well as by the moisture where sap is oozing from their gnawed-out tunnels; likewise by the very offensive smell of the caterpillars, which thoroughly impregnates their tunnels and all about them, and from which the Goat Moth takes its name.

The eggs are laid about the middle of the summer in crevices in the bark, and the caterpillars which hatch from them feed at first in the bark or just within it, and gradually, as they grow, penetrate into the solid wood, where they live for three years, and from their great size, likewise the numbers they are sometimes found in, they do great damage, or sometimes entirely kill the tree.



Caterpillar of Goat Moth (not full-grown).

The above figure gives the appearance of the caterpillar when about two-thirds grown. When quite young it is pink, almost

* The caterpillars of this Moth feed in Poplar, Willow, Elm, Oak, Lime, and Beech, as well as in Apple, Pear, Walnut, and other trees.

precisely the colour of a boiled shrimp; when older it is yellow, with patches or a stripe of dark red along the back, and black spots on the ring behind the head.

Many of the caterpillars may be destroyed by looking for the entrance of their burrows near the base of the infested trees, and then driving a strong wire up the tunnel. If the end comes back with white matter on it, it shows that the caterpillar has been reached. I have also seen it answer very well to use a finer wire, with the point turned back so as to form a hook, to draw the caterpillar out with. A surprising number may be taken out this way.

Where the galleries are so twisted that the wire is of no service, the plans (mentioned in previous Reports) are useful of syringing paraffin or tobacco-water up the hole, or blowing in poisonous fumes. The application of a bit of moist clay will prevent either the fluid or smoke escaping.

Plastering round the base of the trunk of any tree which it is wished to protect with some mixture which will prevent the Moths laying their eggs in crevices of the bark also is a good plan.

For this purpose anything that will quite prevent the Moths getting at the bark will serve. A mixture of clay and cow-dung, if put on so as to adhere and form a reliably thick coat, will answer, or clay moistened with a thick solution of soft soap would do better still. Davidson's composition has not been mentioned for the purpose, but this has been found to act so well in sticking fast the Apple-tree Winter Moths (see p. 5) that it would probably fasten any eggs of the Goat Moth which might be laid so securely as to prevent hatching.

This dressing should be done during the latter part of June, and occasionally repeated, as the Moth comes out in June or July. But where a tree is known to be badly infested it is the best policy to fell it, and split up the lower part of the trunk and destroy the caterpillars; otherwise it will both attract more attack and serve as a centre to spread it.

RASPBERRY.

Raspberry Beetle. *Byturus tomentosus.*

On May 28th I received a communication from Mr. H. Wood, of Crockenhill, St. Mary Cray, Kent, regarding a small brown Beetle, which proved to be the "Raspberry Beetle," *Byturus tomentosus*, which was causing fearful havoc and entirely devouring the Raspberries.

Mr. Wood mentions:—"I have noticed this insect in the Raspberries for some years, but never so numerous as they are this season. I have tried several ways to exterminate them, but to no purpose, and the only effectual means I can adopt to remove them is to employ women and boys to pick them off and kill them; this is a very expensive process.

"This season they have appeared rather earlier than usual, piercing the bloom before it has expanded (this shown by specimen sent). They generally enter the bloom after it has expanded, and then eat completely through it.

"This insect is a fearful pest; the fruit-growers in this neighbourhood complain most fearfully of it."

The *Byturus* is a small Beetle, somewhat less than a quarter of an inch long, generally of a yellowish brown or reddish colour, and covered with a grey or yellowish down. The grub is of a yellowish colour, browner along the back, and with a light brown head. This grub is to be found in June and July in Raspberries and in Blackberries, on which it also feeds. When full-fed it leaves the ripe berries and shelters itself in cracks in stems, or some similar place, where it changes in a kind of cocoon to a chrysalis, from which the Raspberry Beetle comes out in the following spring, and the females presently lay their eggs in the quite young Raspberries.*

The only means of preventing ravage that has been advised appears to be shaking down the Beetles early in the morning (or on dull days when they would not be disposed to fly) into anything convenient, and destroying them. Probably shaking on to tarred boards, in the way which has been found very successful in getting rid of the Raspberry Weevil by growers in Cornwall, would answer well. But further, as the chrysalis winters in shelters amongst old stocks, it could not fail to be useful to clear out all remains of previous year's canes, and also, where there has been bad attack, for some person *interested in the matter* to see whether he could not find the little chrysalis-cases in the rifts of the cut-down stems, and, if so, adopt measures to get rid of them by thick soft-soap dressings poured in, or such other measures as might be preferred.

Raspberry-bud Caterpillar. *Lampronia rubiella*, Bjerk.

The caterpillar of the above very small Moth, unless well looked after, has been found at times to do great harm to the Raspberry crop by feeding within the stem-buds or the tips of the growing shoots. I am indebted to Mr. W. Jenner Weir for the following description of

* 'Prak. Insecten kunde,' by E. L. Taschenberg, Part II., p. 16.

method of attack, and also for the identification of the caterpillar as that of the *L. rubiella.**

On May 2nd Mr. Weir wrote me that a row of Raspberries in his garden at Chirbury, Beckenham, was seriously attacked by these small red larvæ. They were found in the tips of the fresh shoots, which they entered at the growing point when the shoots were about an inch long, and ate their way down towards the cane, thus causing the shoot to wither, and on examination the shoot was found to be quite hollowed out.

The small caterpillars were then only about the eighth of an inch long, of a bright red colour, with a brown head, and a brown spot on the segment next the head. The caterpillars were sometimes seen outside the shoots, but they were in no case found to *leave* the bud which had been attacked, so that, as far as could be seen, each caterpillar only destroyed one shoot. Where there were two buds from one eye it was rarely found that more than one was attacked.

The remedy applied was to cut off the infested shoot, and to destroy it with the insect within. In the hundred canes or thereabouts operated on about half the buds were found to be infested. The disbudding, of course, strengthened the growth of the buds that remained, which grew luxuriantly, and bore a very large crop.

The life-history of this Moth is given in detail by Prof. Westwood in a paper of the 'Gardeners' Chronicle,' to which reference is given below, from which I extract the following information :—

The caterpillar turns to chrysalis in a slight web amongst the shrivelled leaves from about the middle of May to the beginning of June. The Moth, which comes out from this chrysalis in about a fortnight or three weeks, is very small, scarcely half an inch across in the spread of the wings. It has brown wings, the upper pair spotted with gold-colour, of which spots two of the larger ones meet when the wings are folded along the back. [Somewhat like the pattern of the "Diamond-back Turnip Moth," see fig.—Ed.] The female Moth lays her eggs in the Raspberry stem, the young caterpillars hatch at the beginning of August and feed on the Raspberry foliage, and *secrete themselves during the winter.*—See Gard. Chron. for 1858, p. 757.

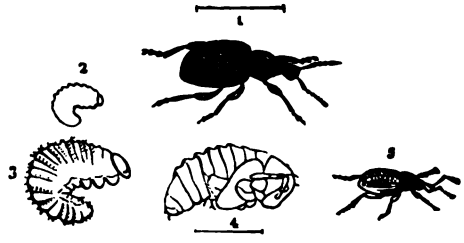
With regard to measures of winter prevention, it is plain that, as the caterpillar takes up its winter-quarters either in such shelter as it

* The many appellations that have been bestowed upon it, of which the list is given by Prof. Westoood in his excellent paper on this insect (Gard. Chron. 1858, p. 757), are of some interest, as showing the great difficulties which variety in scientific name causes to enquirers. The Moth was the *Tinea corticella* of Linnæus; the Swedish naturalist, Bjerkander, named it *Tinea rubiella;* it was placed by Stephens in the genus *Lampronia;* Fabricius named it *Alucita variella;* Duponchel gave the specific name of *multipunctella;* Sodoffsky that of *Fischerella;* and it is stated to be the *Glyphipteryx variella* of Stainton's 'Catalogue of Tineidæ.'—Ed.

can find on the stems or amongst the earth at the root of the plant, that these are the points to be met. Clearing away all wood that is not wanted, as thoroughly as it can be done, including in this the removal of all old stumps of former canes, would get rid of a deal of *shelter*, and thoroughly stirring and throwing aside the earth which is just at the base of the canes would get rid of whatever was *sheltering*. There would be no need to carry it away, for the simple exposure to wet, together with cold on the surface, would soon kill these small caterpillars.

This attack may be taken as an example of many kinds in which it is only necessary to mention the habits of the "pest" for each grower to be at once able to tell for himself how to get rid of it far better than by advice from others.

Brown-legged Weevil. *Otiorhynchus picipes*, Fab. (and other species).



OTIORHYNCHUS SULCATUS, &c.

1—4, *O. sulcatus*, larva, and pupa, magnified, with lines showing nat. length; 5, *O. picipes*.

The following note, sent me on May 24th, with specimens accompanying, by Mr. G. Bradley, Ivy Hatch, Sevenoaks, gives some idea of the enormous amount of injury caused by this Weevil (the *O. picipes*, sometimes known as the Clay-coloured Weevil), as well as by other kinds of *Otiorhynchus*:—

"Please find enclosed some Beetles, also a twig of Red Currant, Cob Nut, Damson, and Raspberry. You will see the damage they do in fruit plantations by biting the bark of the hard wood, and the way they eat the young Raspberry twigs. This season they are very numerous, and have made sad havoc in some fruit plantations in this neighbourhood.

"We never find them on *very* sandy soil, only on loamy soils; they hide up in the day underneath the small clods close to the stems of the various trees they feed on.

"I have tried quick-lime, soot, and paraffin diluted with water: whatever you do appears no good, excepting catching and killing them.

I have caught 105 Beetles round the stem of a Cob-nut tree. My neighbour planted 150 Briar-stocks for budding Roses on; they have eaten every bud out of the stocks."

On June 6th Prof. Allen Harker, of the Royal Agricultural College, Cirencester, forwarded specimens of another species (*O. tenebricosus*), which were then doing much harm by eating leaves of the Strawberries in the garden of the College Farm. This kind is about the size of the magnified figure of *O. picipes* given, but differs in being more pointed at the tail, and also in being of a bright shiny black colour.

The Weevils were in such numbers that thirty of them were secured in a few minutes from their daytime shelter around the Strawberry roots. A female that was dissected contained eggs fully developed.

The habit of the Weevils mentioned in both the above communications of sheltering away from the light during the day is one great means of keeping them in check. With regard to the Strawberry plants, a temporary shelter, such as pieces of boards or tiles, was laid along by the plants, and, on raising these, the Weevils were found collected in such numbers beneath, that nothing further was needed to clear them out, excepting sending a boy round regularly to gather them up and destroy them.

In the larger scale of plantation fruit-growing it would be some slight expense to have them thus collected, but still this would be nothing to the loss from damage to the plants. It would soon be found what kind of shelter they preferred, and by placing some of this, whether slates, tiles, odd bits of thin turf, or *morsels of old waste sacking*, on the ground by the stems of the young trees, these would probably form excellent traps, which might be cleared daily with little trouble.

Where the infested plants are large enough to admit of the Weevil being shaken off (when they have gone up again to feed at night) on to *tarred boards*, or anything placed below to catch them, this plan answers thoroughly well. (See account of method of clearing *O. picipes* in Raspberry grounds in Cornwall, 'Report of Injurious Insects,' 1879). Something might also be done by putting some sticky mixture round the base of the trunks of the young trees (see p. 5 of present Report). Anything would serve the purpose that would not hurt the bark enough to damage the health of the tree, and which, either by stickiness or by being obnoxious to the Weevil, would catch it fast, or prevent it walking over the band of smeared-on preventive.

Tar and cart-grease mixed might do very well, for it would keep damp for some time, or "Davidson's Composition" would perhaps answer as well for this purpose, as for catching the wingless Winter Moths as they creep up the tree stems, as before mentioned,

Otiorhynchi lay their eggs in the ground, and their maggots feed on roots and turn to chrysalids in the ground. Where it is possible to apply a good quantity of gas-lime I have found it answer to clear out the maggots, as well as it could be managed, and put gas-lime as a coating. In the case of young trees a layer might, I believe, be safely put, say for a fortnight, on ground supposed to be infested, and of which the uppermost four to six inches had been turned to the top. All the maggots and chrysalids thus buried in the gas-lime would be killed, and the material could be removed if too thickly laid on to remain safely. Lime or quick-lime does little good in cases like this compared to the caustic gas-lime, which kills the soft maggots if it touches them, or poisons them by the dissolved fluid running on the first rain, from it into the infested ground.

STRAWBERRY.

Strawberry-leaf Button-Moth. *Peronea ? comariana*, Zell.; *P. ? comparana*, Hüb.

PERONEA (? COMARIANA).*
Moth, and caterpillar hanging from leaf by thread. (Fig. drawn by Dr. Ellis.)

* The *Peroneas* form a genus of exceedingly small moths somewhat uncertain in distinguishing points. The above specimen having been variously named by two skilled authorities, I give both names to save possibility of error as to species.

The following observations on the attack of a Moth-caterpillar often severely injurious to Strawberry leafage was communicated by Dr. Ellis, of Liverpool, from Mr. Richard A. Wrench, Dee Banks, Chester:—

"I enclose specimens of a grub which infests the Strawberries about here (Dee Banks, Chester), and does a great deal of harm; the bulk of the Strawberries for Liverpool Market are from here. I may say it usually makes its appearance about the beginning of May, and lasts until about the end of August, when it goes away.

"Young Strawberry plants of twelve months old are never affected; two-year-old plants are affected rather badly, but three-year-old plants are invariably ruined.

"I have two fields adjoining one another, the old field utterly ruined by the grub, the next, only separated by a hedge, perfectly clear; but next year, when it will be two years old, it is sure to be full of blight."

Here we have only the above notes and Dr. Ellis's sketch* to guide to means of prevention, but I think these are enough to help us.

It will be noticed the caterpillar is hanging by a thread, and, as it has the *means of lowering* itself to the ground, it is very likely that though many may turn to chrysalids in the spun-up leaves, yet that many may go down their thread to the earth, and the winter brood there turn to chrysalids, and that it is from these chrysalids that the Moths come out in the following spring, at the season to start a new attack on the new leafage in May, as mentioned by Mr. Wrench.

Mr. Wrench notices the absence of attack in the first year, moderate attack in the second, and devastation in the third, which also seems to me to point to the chief numbers of attackers coming up out of the ground, for, if these little Moths *flew* to the plants in any great numbers *from elsewhere*, the attack might be expected to be much the same in amount on beds one or two years old.

If this is the case, the treatment of skimming off the surface-soil with the chrysalids in it, and getting rid of it in such a way that the

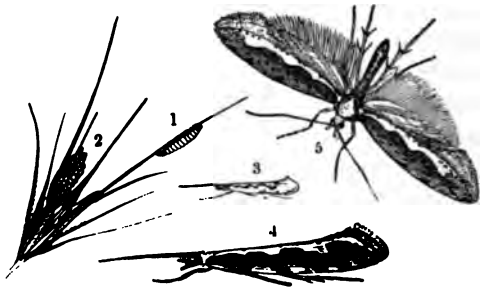
* The following description of the Moth, *Peronea* (? *comariana*), in its three stages, is communicated by Dr. Ellis:—"*Larva:* Cylindrical, shining, slightly bristly; head glassy, pale yellow, with brown spots on each side behind; general colour green, darker above, lighter below, with the dorsal vessel well marked and darker. Feeds in May and early part of June on Strawberry, drawing together the leaves and flowers for this purpose, in the latter case feeding on the calyx and receptacle. *Pupa:* Pale green, with reddish wing-cases and abdominal segments. *Imago:* Emerges end of June. Fore wings very pale ochreous, slightly darker on the hinder half; near the middle of the costa is a dark brown, nearly black, triangular blotch, reaching two-thirds across the wing, and continued to the inner margin as a slight brownish cloud. A dark patch on the inner margin indicates the edge of the basal patch. Hind wings grey."

Moths should not hatch out to renew attack, would answer as well in this case as it is known to do practically in getting rid of Gooseberry caterpillars. If the soil is only stirred and manured, and the plants roughly trimmed, this does very little to clear out chrysalids; but in skimming off the soil with the withered leaves, which have been webbed-up in summer, the chrysalids would be carried off also, and from one place or other (either on the soil or in it) one might entirely hope to get rid of the chrysalids that would start the next year's attack.

Further details of the life-history of this Moth would be acceptable, as great injury is done elsewhere by Moth-caterpillars to Strawberry grounds, and very little (beyond this damage) is known of their habits.

TURNIP.

Diamond-back Moth. *Plutella cruciferarum*, Zell.; *Cerostoma xylostella*, Curtis.



CEROSTOMA XYLOSTELLA.

1, caterpillar; 2, eggs; 3—5, Diamond-back Moth, nat. size and mag.

The appearance of the Diamond-back Moth caterpillar on the Turnip crops is of a good deal of interest, as this attack has only been recorded (with us) now and then, and when it does happen it is often very destructive. It is open to doubt, however, whether it is not more common than has been supposed, and that the attacks may have been passed over as those of the "Nigger" or Turnip Sawfly caterpillar.

The Diamond-back Moth is of the size figured above at 3, with a pale stripe and spots along the hinder edge of the fore wings, which give the appearance of a row of diamond-shaped markings running along, as shown (magnified) at 4 and 5. These Moths fly in the

evening, and lay their eggs (sometimes in great numbers) on various kinds of plants, and especially infest all the Cabbage tribe.

The caterpillars are about half an inch long, and slightly tapering to the head and tail, green or yellowish in colour, with grey or black head, and the ring next the head has several small black spots. These, when full-fed, spin cocoons of fine net-like texture on the remains of their food-plants, or on the ground, from which the Moth comes out in about three weeks or less, so that there may be a succession of generations during the summer. The autumn chrysalids remain unchanged during the winter. The caterpillars feed in heads of Cauliflower, and on unripe seeds of some plants of the Cabbage kind, as well as on leafage.

The first specimens of these Moths were sent me on July 9th by Mr. Edward Riley, from Kipling Cote, Market Weighton, who mentioned, on August 27th:—"When we began to hoe the Turnips on July 9th I was struck with the number of Moths flying about (hundreds of them), and was certain mischief would follow. However, the caterpillars did not do much harm to the early White Turnips, but some Rape in the same field was damaged seriously. The Rape leaves had white patches as large as a shilling all over the leaves, and, in the case of a neighbour's Rape adjoining, the leaves were quite blanched." [This white appearance was probably from the exceedingly fine web, like the thinnest gauze, which the Diamond-back caterpillars have been noticed as spinning over parts of the leaf whilst feeding (see Curtis's 'Farm Insects,' p. 87).—Ed.]

Mr. Riley further says:—"I had a field of Swede Turnips attacked, and at once sowed nitrate of soda at the rate of 1 to 1½ cwt. per acre, putting a small quantity on each Turnip, which in ten days had a marvellous effect, the Turnips growing right away from the attack.

"I think the reason the caterpillars have done so little damage among the early White Turnips is that they grew so wonderfully well from the first."

On July 30th I received information from Mr. H. Stourton, of Holme Hall, York, that a great deal of damage was being done to Turnips by a caterpillar (of which specimens were enclosed) feeding on the leaves. These caterpillars proved to be of the Diamond-back, and nitrate of soda was about to be used to "put some strength into the plant."

On August 8th Mr. Stourton mentioned that he hoped not to suffer to any great extent, but that there were bad accounts from some farms in the district up to a week before; the Turnip plant had been looking very weak from the wet cold weather, but was then looking more healthy. He notes:—"I put on nitrate of soda and soot where the caterpillars were numerous; we shall see the result. One of my

workmen said that he remembered these pests in other years, and he had known farmers tie Willow branches on the scufflers to sweep the leaves. At this date some of the caterpillars were turning to chrysalids, and on the 21st of the month the Moths were appearing. At this date (from favourable weather for growth) some of the damage was being repaired, but it is noted that "here and there patches were entirely destroyed in spite of the nitrate of soda." It is also noted, "I think sweeping the leaves with Willow branches has done some good."

The information in the above short notes which Mr. Stourton favoured me with is very useful, as showing the amount or the effect of attack may be much lessened by a hearty growth of the plant, whether from favourable weather or from the use of fertilisers which would act at once, such as nitrate of soda. Also that the mechanical measure of brushing with boughs, which is useful for getting rid of the "Niggers," is available here.

The Diamond-back caterpillars let themselves down by a thread when alarmed; consequently, by the passage of the scuffler after the boughs, many must get destroyed on the ground.

About the beginning of August I received the two following notes through the 'Mark Lane Express,' which, by the courtesy of the Editor, I am permitted to use, describing outbreaks of what appeared to be the same kind of attack near Harwich, and also near King's Lynn:—

Mr. Stanford mentions from Great Oakley, Harwich:—"I enclose Kohl Rabi and Swede plants, which you will perceive are very much eaten by a small green caterpillar, some scores of the insects being on the plants in the box. The fields of Turnips in this district are almost destroyed, several pieces having been ploughed up in consequence of the damage done by this insect. Can you kindly inform me what the name of the caterpillar is, as I never remember seeing it until this year? I myself have sixteen acres of Swedes eaten like the plant enclosed."

The note given by Mr. F. J. Cooke on August 10th from Hitcham Abbey, King's Lynn, likewise mentions the serious nature of the attack, and it being of a kind not generally known. He says:—"I send you by this post some Swede-Turnip leaves, which you will find are perforated by a little caterpillar, two or three of which you will find still on the leaves. Two others have spun themselves a cocoon, in which they are awaiting the next stage of their existence. These pests are, of course, quite distinct from the brown grub or caterpillar that attacks the Turnip root, but they promise to ruin much of the later Turnip crops in this district, and are new to me and all of my neighbours to whom I have spoken. They and I will be interested if

you can help us to some knowledge of the life-history of this new enemy, which promises to be as destructive as the fly which attacks the leaves of Beet."

With regard to remedies, the treatment for Turnip Sawfly attack (see previous Reports) appears best, that is, all measures to *secure good growth*; likewise brushing of the caterpillars with boughs in whatever way may be most convenient; and also *not* hoeing or singling when bad attack *is present*. Probably diminishing the wild plants which attract the Moth would also make a difference.

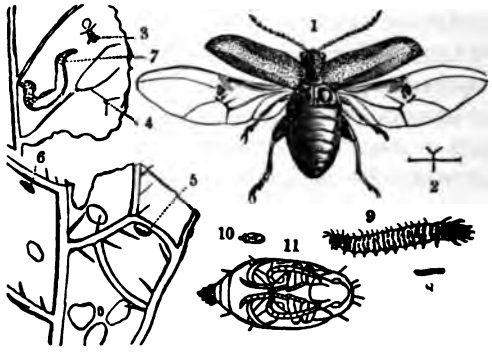
I am favoured by a note from Lord Walsingham of *Plutella cruciferarum* having been remarkably abundant this year, and of his having found the caterpillars feeding in great numbers on *Sisymbrium Sophia* (the fine-leaved Hedge Mustard or Flixweed).

This caterpillar also feeds on other plants of the Cabbage tribe, as "Jack-by-the-Hedge," which grows on hedge-banks, "Wall Mustard," and others. It also frequents the *Salsola Kali*, or Saltwort, a plant very nearly allied to the very common Goosefoot and Orache of the fields, but which grows by the sea-shore, and may have to do with the attack of the Diamond-back being often noticed near the coast.

Note.—The following very good observation of attack in Caithness, which I consider very likely to have been caused by the Diamond-backs, was sent me by Mr. George Brown, of Watten Mains, Caithness, but to my regret I was unable, at the time of receipt, to identify the caterpillars with certainty; therefore, as the account of such wide-spread damage is of considerable value, both in itself and for future reference, I give the report as a note :—

"But the most persistent pest of the season on our Turnip crop is that of the insect of which a specimen caterpillar was sent you some time ago. Its ravages on the leafage have been very great, so much so that on many fields, especially along the sea-board, fears are entertained that the plant cannot bulb. Driving round the coast the other day [date of letter, Oct. 3rd.—Ed.] we were much struck by the appearance of the leaves; they looked as if the crop had been thickly powdered with quick-lime. On close inspection the green parts of the leaves were found to have been completely eaten away, and the remaining membrane was so punctured in every part that it forcibly reminded one of white net, or still thinner web. Their manner of feeding is somewhat different from Sawfly caterpillars; they descend the leaf-stalk and conceal themselves during the day in the heart of the top where it joins the bulb, and come out at night to feed all over the leaves."

Turnip Fly. *Haltica* (*Phyllotreta*) *nemorum*, Curtis.



HALTICA NEMORUM.

Turnip Flea Beetle, eggs, maggot, and pupa; nat. size and mag.

The subject of Turnip Fly was so fully reported on in 1881* that it appears as if little could be added for general use to the practical methods of treatment then noticed. The two or three following observations may, however, be of use in drawing attention again to some of the more important points of treatment, as the application of dressings *when the dew is on*, and the Flea Beetle consequently cannot use its leaping powers to get out of harm's way; the use of mixing Mustard with Turnip seed to draw the Flea Beetle away from the Turnip when the young plant comes up; the importance of all agricultural measures to give such a healthy growth as will run the young plant quickly on past the stage for attack; and likewise the benefit from watering, *where this can be managed*, and the application *continued* during time of drought.

Mr. D. Byrd, writing from Spurstow Hall, Tarporley, mentions "the Turnip Fly has been less troublesome this year. I believe that I have saved the crop many times by dusting a little soot and lime on the Turnip leaf *in the early morning while the dew is on*, leaving the Charlock and other weeds untouched between the ridges for the Fly to feed upon until the Turnip got its rough leaf."

Mr. Edward Lingwood, writing from Thwaite Stonham, Suffolk, mentions:—"It is at least twenty years since I had any occasion to resow Swedish Turnips, my plan being, after getting the land as level and in as good tilth as possible, to plough it into ridges 27 in. apart about the end of May. Between these I spread twelve cart-loads an acre of farmyard manure that had been previously fermented in a heap, on this dressing sowing broadcast 3 cwt. of superphosphate, the ploughs following as quickly as possible. As soon as the ridges

* See 'Report on Injurious Insects for 1881,' pp. 47—97.

are dry enough a light rolling is given. The next proceeding is to mix equal parts of Swedish Turnip and common Mustard seed together; a single row of this is then drilled on each ridge at the rate of three pints an acre, a light roll following to put out the drill-marks. This is important, as I long ago discovered that, while the insect took off the plants that stood in the hollows, those on the hills escaped with a mauling; this of course was when the seed was sown broadcast. Mustard seed is not only 50 per cent. cheaper than Swedish Turnip seed, but the plants are more easily singled where it is made use of.

"For White Turnips I make 24-inch ridges, sow a liberal quantity of superphosphate and plough it in, as I drill these late to stand the winter. I seldom have much trouble with the insect; if so, I use the light roller.

"This spring I drilled some Enfield Market Cabbage the beginning of April, and, thinking it too early for the enemy, mixed some dead Turnip seed instead of Mustard with the Cabbage; this proved an unfortunate mistake, for just as the plants appeared we had a hot day or two, and the consequence was I found from three to five 'flies' on every plant; but some slacked lime *sown early* the next morning saved the crop, whilst a neighbour lost his entirely."

Mr. James Whitton, Coltness Gardens, Wishaw, N.B., notes:—"I have found the use of water of great use in checking 'fly.' On its first appearance I dust the bed or seed-lines with lime *early in the morning*, and, if the weather is at all dry, we water the Turnips regularly *at night* until the plants are all safe. This I have practised for many years."

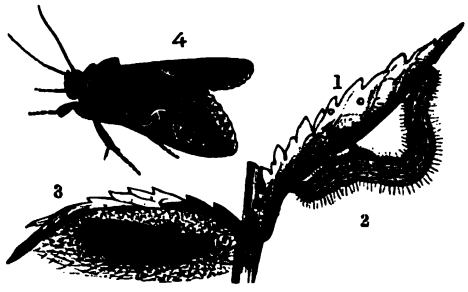
Turnip Fly is mentioned by Mr. Robert Coupar, of Colenden, Scone, as having been very injurious to the crops in that neighbourhood in 1888, many farmers having been obliged to sow two and three times.

Silver-Y Moth. *Plusia Gamma*, Linn.

On October 3rd Mr. George Brown forwarded me from Watten Mains, Caithness, N.B., a specimen of a Moth developed from a green caterpillar, of which the attack had been doing much harm to the Turnips by eating away any green part of the leaves which had escaped the attacks of the other kinds mentioned at p. 75.

With these were forwarded moth-chrysalids in web cocoons, with the note:—"Corn crops are perfectly covered with these cocoons; between the sheath-leaf and stalk in the Corn, in the seed-stalks of Sorrel, and on every and all parts of the Field Thistle, the cocoons appear."

Later on, on October 16th, more specimens were sent, which showed the Moth to be *Plusia Gamma*, or Silver-Y Moth, sometimes



PLUSIA GAMMA.
Silver-Y Moth, caterpillar, and chrysalis in cocoon.

known as Beet Moth, which is figured above, together with its "half-looper" caterpillar and the light web cocoon in which it changes to chrysalis.

This Moth does not appear to trouble us much here, but on the Continent it occurs from time to time in vast numbers, and the caterpillars are most general feeders.

Amongst cultivated plants which they attack are leguminous plants, such as Peas, Broad Beans and Kidney Beans, and likewise Clover. Turnip leaves and various plants of the Cabbage kind, and likewise Lettuce, and Beet also, are sometimes severely injured. Corn crops have escaped a while when bad attack was going on, but after a time the Oats were found to be suffering.

Amongst the common weed plants which serve as food, John Curtis mentions Thistles, Burdock, Nettles, and others, and also grasses.

From continental observations it appears that some of the *caterpillars hybernate;* these are only about half-grown when winter comes, and reappear to go on feeding and complete their growth in the following year; but I have not found any note of this taking place with us, and I have had specimens as chrysalids in cocoons developing into Moths in the middle of October. This is an important point to know more about, as, in case of *P. Gamma* only passing the winter with us, either as stray specimens of the Moths or as chrysalids above ground, exposed to changes of weather, it would at once account for the attacks being much less severe than where there is a late brood of caterpillars safely stored during winter in their own chosen shelters to come out again in spring.

Where the attack is found on Turnips any measures calculated to brush them from the leaves, such as those advised (p. 75) for Sawfly caterpillars, would be desirable. In gardens hand-picking is best, so as to make a thorough clearance at once.

SLUGS.

Field Slug. *Limax agrestis*, Linn.

Black Slug. *Arion hortensis*, Ferussac.

These common pests have been reported as very injurious at various places in the past season, and, as the treatment in the following case proved successful in clearing a bad attack, I am kindly permitted to give the following communication :—

On July 31st I was favoured with a note from Lord Portman relatively to Slugs, which were causing much harm to his Turnip crops at Bryanston, Blandford. The specimens forwarded were mainly of the Field Slug (*Limax agrestis*),* together with a very few of the *Arion hortensis*, sometimes known as the Black Slug.

The attack, which was to Turnips on land broken up after Clover, which had been mown in two successive years, was very severe. The Turnips had been resown twice, and on each occasion the plant had been destroyed by being eaten just above the root and below the leaf. Salt had no effect, and lime also failed. Looking at the point that the Slug has a power to moult off a coat of lime a *few times* successively, and thus get rid of an obnoxious dressing, but that after this operation has been repeated two or three, or at least a few, times that the creature requires an interval to regain this power, it was suggested to repeat the dressings several times, *as near together as could be*, and the result, as shown by the note given by permission of Lord Portman, was a thorough clearance.

It is mentioned:—"We ploughed a furrow round the attacked plot, and filled it with quick-lime to cut off pest invaders. We fed the adjoining land very close with sheep and cured any Slugs therein. We then dressed the Turnip land with a mixture of soot and lime in one part and salt in the other. The first day did but little good; the second doses were effectual, and, being repeated at dawn and dusk, killed the enemy.

"The soot and lime acted best.

"We have now a good crop of Rape, which was sown when the

* The *Limax agrestis* is exceedingly common, and may be distinguished in a general way by its moderate size, its light ash or cream colour, which has been stated to get darker and mottled with brown flakes later in the season, and also by the shield on the back having slight concentric lines on it, which are more faint and distant than in the other species. It is stated to produce several families, averaging fifty each, during the season. The *Arion hortensis* is also very common, and is about the same size as the "Field Slug," but may be known from it by the shield having a rough surface, as if shagreened. The colour is wonderfully variable, being "brown, red, yellow, grey, greenish, or black," usually somewhat striped along the back and sides, and covered with coarse oblong tubercles. (See Jeffrey's 'British Conchology,' vol. 1).—Ed.

Turnips were devoured, and of Turnips in the parts which were saved by repeated dressings."

On Sept. 13th Mr. Jabez Turner, of Norman Cross, Peterborough, mentioned that a field sown with *Trifolium incarnatum* on August 30th was being much injured by some pest, and on Sept. 21st he forwarded specimens of Slugs which, with many others of the same kind, he had found that evening amongst the *Trifolium*, "the plants of which have now nearly disappeared." Mr. Turner further notes that the *Trifolium* was sown on Oat-stubble after Mangolds and Potatoes, and that the Slugs were smaller than the kind which usually does so much damage to Clover Ley Wheat.

This Slug was the *Limax agrestis*, sometimes known as the Field Slug or Milky Slug, from its abundant viscous or milky slime.

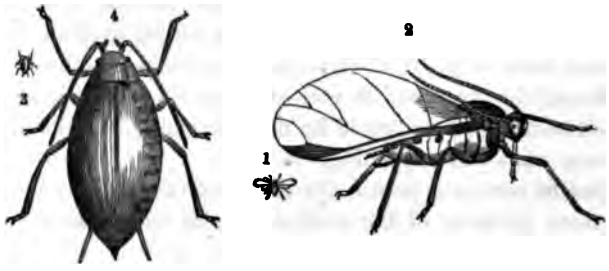
A great deal of loss both in garden and field would be saved by considering the above power of the Slug.

Where a heavy dressing can be put on, as we may do on unoccupied land, so that wherever the Slug crawls there is the obnoxious stuff, it would soon exhaust its slime-producing power and perish; but where there is a growing crop this can seldom be managed. Lime slakes rapidly in the dew of the morning or evening when the Slugs are out, which is the time for dressing, and if, as is frequently the case, it is thrown at a *few days interval*, it is too often waste labour. I have seen the Slug resting as comfortably in the slaked lime as if under a stone; but, on the contrary, where the dressing is given as above *at short intervals*, there would be every reason to hope the pest would be got rid of.

APPENDIX.

OBSERVATIONS ON FIRST APPEARANCE, &c., OF HOP APHIS.*

Hop Aphis. *Aphis (Phorodon) Humuli.*



1 and 2, Winged Female Aphis; 3 and 4, larvæ or lice; nat. size and mag.

The following observations regarding Hop Aphis were sent to me during the past season in answer to my circular of March 8th of the present year, requesting information from those conversant with the subject as to *first appearance of Hop Fly or Louse.*

I much regret that they are so few in number compared to what could be wished for on such an important subject, that consequently the method of Hop Aphis attack, that is, the place *from* which—or the form *in* which—it comes, cannot yet be considered as proved; but I submit the notes to the contributors who have kindly sent them in the hope that they will turn over the matter in their minds, and work the subject forward further in the coming season.

As points connected with Hop-growing can only be judged of properly by those who have a practical knowledge of the subject, I give the notes, as nearly as possible, in the senders' words, merely removing observations which did not especially bear on the subject in hand, and also dividing the information given under different heads.

It will be seen, firstly, that with *few exceptions* the contributors agree in the point of the Hop Aphis being *first observed as Fly*,—that is, in the winged form,—and *also* that it has been first observed by

* This paper, in a separate form, was distributed earlier to contributors of the information, and some others, for observation during the present winter.—E. A. O.

them towards the *top of the plant;* secondly, observations are given of the Hop Aphis *occurring on Plum and Sloe.*

Observations are likewise given as to Hop Aphides and their eggs *not having been as yet found* in winter shelters, also on Hop Aphis *having been found* on Nettle.

An important observation is given of Hop Aphis appearing on a plant which had been enclosed carefully from outside attack.

There are also notes on benefit from *healthy* growth; from *washings;* and from presence of Ladybirds.

Still, however, it appears to me that the *only* method by which we can make absolutely sure whether Lice come up from the ground or not is by isolating Hop plants. This is the way in which the history of the Vine *Phylloxera* was completed, and, though there would be difficulty in elaborate arrangements, there would be little trouble in the method noted at p. 10, of fastening three poles together at the top, and enclosing the plant within with stout muslin, so early in the year and so securely that there could be no entrance from outside. So we should *know* what was happening.

At present *nothing is proved*, but there is no doubt that Aphis attack is considered by most of the contributors of the following notes to appear first as "Fly."

With regard to what plants these "Flies," *i. e.*, winged Aphides, come from, it may be from *Plum or Sloe*, or apparently it may be from *Nettle*. I have had opportunity of making sure, through the assistance of Mr. G. B. Buckton, F.R.S., that specimens of Aphis on Plum leaves were the same kind as the Hop Aphis; and also specimens of Aphis were sent me on Nettle leaves, which I could not find differed in any way from Hop Aphis.*

Observations of the First Appearance of Hop Aphis as "Fly," and on the Upper Part of the Plants.

The following communications give observations of the Hop Aphis being first observed as Fly, *i. e.*, winged; also of attack beginning on the outside of the gardens, when the wind is from a cold quarter; and that ground exposed to cold winds, or cold and damp, are found to suffer.

Dr. Chapman's note regarding larger wingless Aphides being observed by him in 1882 amongst a large number of small ones, is

* The reader will please observe that, though the common English names are used for convenience, I am not confusing the various sorts of Aphides. By the Hop Aphis throughout I mean the *Aphis* (*Phorodon*) *Humuli* or the *Aphis* (*Phorodon*) *Mahaleb* (which *may* be a variety, but if not, is *the same* as the *A. Humuli*); and it is this *A. Humuli* or *A. Mahaleb* which I allude to as having occurred on Plum and Nettle. I am not referring at all to *Aphis Pruni*, nor to *Aphis Urticaria*, nor to *Aphis* (*Siphoncphora*) *Urticæ*, or any other Aphis of the Plum or Nettle, only to the Hop Aphis.

very valuable, as it points to the likelihood of the *wingless females* having wintered in the earth and starting attack, as well as the winged females. In some cases the observations were sent me every few days, and I give these short notes with the dates, as it shows the careful watch kept. The first note is as follows:—

"I have about thirty acres of hops. The Fly has always been observed first. I do not think I have ever seen it until the Hops were from three to six feet high. It is always seen first on the latest or youngest leaves, *i. e.*, within an inch or two of the head of the shoot, and before the leaf is developed.

"With a slight attack of Fly there are about three or four Flies on the top leaves of nearly every Hop; in a bad blight the leaves are nearly black with them.

"The Fly always, or nearly always, appears when the wind is in the east.

"I have some Hops growing in a low situation, nearly on a level with the river, and they always suffer most from the blight."—H. H. Deane, Elbridge House, near Canterbury.

"I have for upwards of fifty years been a close observer of the Hop plantations in this district, and still continue to be so.

"The first Aphides which appear are the winged ones; they are found on the tender leaves of the plant, on the outsides of the gardens, generally on the E. or S.E. sides. There appears to be a certain locality in every plantation where the first are to be found; and the same (or very similar blight) *is to be found on the common Nettle* (see p. 9), and, as long as it remains on the Nettle, it is sure to be found on the Hop.

"If the outsides of the garden can be kept free from blight, the middle takes no harm. I have never found Lice making their way up from the ground, but invariably first found them on the young leaves on the top of the plant where the winged Aphides exist, or have done." —J. W. Hopkins, Lower Wick, Worcester.

"The Hop Fly generally appears in the middle of May or early in June outside the grounds, and the coldest situations are attacked first, where the cold winds have most power and the flow of sap of the plant is most checked. I have known some seasons entirely without them, in a fine healthy time propitious for the plant.

"Sometimes we find that yearling and two-year-old grounds are free from the pest, and grow kind Hops when all others fail. This I attribute to the healthy young plant."—Richard Heming, Cheltenham.

"During my experience I could never make out where the Hop Fly come from. I only know that they come in the early part of June as a Fly. Should the season be wet and cold they increase very fast, and become a general blight: they have made their appearance during the

last few days (letter dated June 18th, Ed.), but, the weather being very warm and the bine full of sap, I think they will be quite overcome this season."—B. Bishop, Mill Farm, Pencombe, Bromyard.

"My own impression (at present) is that the Aphis first presents itself as the Green Fly, which speedily deposits an enormous crop of Lice."—E. Monckton, Hale Place, East Peckham, Tonbridge.

"May 26th.—Fine showers from the north, with brilliant day following. Hops perfectly clear of Aphis.

"May 28th.—Long-winged Fly made its appearance in considerable quantity. Careful examination of the hills discloses none other than on the first upper pair of leaves: no 'Louse' to be seen or egg at present. Only one garden yet attacked, and no Plum, Sloe, or Blackthorn tree round any of its hedges.

"I have searched several hills with Fly on the top to see if I could discover any working up the bine, as if from the ground, but without success.

"May 30th.—I find less Fly this morning than on the 28th, but I found on what would *then* have been the first upper pair of fully-expanded leaves (now doubled in size), a few straggling 'Lice,' and all search on leaves below these (which, I submit, the 'Fly' settled on) prove them as free as possible.

"I have been examining Sloe and Blackthorn bushes in the immediate neighbourhood of the Hops, but they appeared remarkably free from blight of any sort." — George Turvill, East Worldham, Alton, Hants.

"I have not a shadow of doubt but that the generation in the spring commences with the Long-winged Fly. They appeared this year (very sparsely, it is true) about the usual time, and quickly laid a thin sprinkling of young nits."—D. Turvill, West Worldham, Alton, Hants.

"Here and there a straggling Louse has been seen. The first Fly I saw was on Sunday (June 3rd), and now there are not many.

"June 8th.—I enclose you herewith insects from Hop leaves. (These were Hop-lice, that is, Aphis, in first stage or stages, one having just shed its skin, and winged Fly).

"June 14th.—The day before yesterday I had a hunt for nearly two hours to see if I could find an Aphis on the branches near the ground, but without success."—W. Gardner, Bekesbourne, near Canterbury.

"June 15th.—Respecting the Hops that we have in the garden for experimenting on, I have closely watched them from the time the young shoots first peeped above ground, and up to June 2nd they were as clean as could be, not the slightest trace of Aphis to be found. On the afternoon of June 2nd, on examining the bines, I found a few Fly,—very few,—perhaps one or two on a shoot, but I particularly

noticed that none of the Fly were low down on the bines, and they also appeared to be very weak."—ARTHUR WARD, Stoke Edith Gardens.

"May 28th, 1883.—I beg to hand you herewith a winged Aphis from Hop. I have two more I can send you, if you desire them. These were got yesterday looking over (under rather) some hundreds of leaves in a hop-yard; only these were then met with. Each was ovipositing,* and on the leaf with each was (at some small distance) one small, newly-hatched, Aphis; on no other leaf was a wingless Aphis seen, except on one leaf (of the same plant with one of these Aphides) four very small Aphides were found.

"Last year (1882), somewhat later than this, I saw no winged Aphis, yet *every leaf* had small Aphides (perhaps fifty to a leaf) tolerably uniformly distributed over it. These could not all have been the progeny of winged Aphides, and there were larger ones amongst them.

"May 31st.—I yesterday visited another hop-yard, and found the Aphis more abundant, but hardly any young ones. Each Aphis had deposited not more than one or two, judging both from the size of the young Aphides and their numbers.

"June 2nd.—The winged Aphis is more abundant, but only at the margins; the centre of the Hop-yard is still quite clean. The young Aphis only occurs with the winged Aphis, and is on the under side of the full-grown leaves, where an occasional Aphis ovipositing (see note) may be found. The mass of the winged Aphides are in a sleepy state on the leaves of one or two inches long.

"July 2nd.—In the Hop-yards the plants are not only outgrowing attack, but some circumstances must be terribly against it. Most Hops have Aphides, but these are nearly all the newly-hatched ones, and they are not abundant."—Dr. T. A. CHAPMAN, Hereford.

I have communications from various observers of Lice being seen later in the year, that is about August, on branches and leaves near the ground, which is important practically because in these cases, where attack is confined to the lowest parts of the plant, the spread may be checked by the treatment advocated by Mr. C. Whitehead, of removing these infested leaves and branches, and destroying them before the Lice on them can come to the winged state; and also feeding them off by sheep. But, with regard to its bearing on first appearances, I would submit this fact of the Lice *being seen* on the lower leaves at a later date strengthens the probability that they were not there to begin with, for the simple reason that it shows that they are plainly distinguishable when in any quantity.

* "The ovipositing is doubtfully entitled to the name, the young Aphis being perfectly developed, but I think within a membrane."—T. A. C.

OBSERVATIONS AS TO THE HOP APHIS MIGRATING FROM PLUM AND SLOE.

In the following observations the Hop Aphis is noted as *migrating from Sloe, Plum*, and other trees. With regard to the Sloe and other kinds of wild or cultivated Plum there appears no reason why this should not be the case.

Our own observations this year have shown that Hop Aphis is to be found infesting the Plum, and previously to this notes have been published by three well-known German entomologists, stating respectively that the Hop Aphis is found on Sloe, and therefore Sloe bushes ought not to be left near Hop-grounds*; that this Aphis is to be found in May in great numbers beneath the leaves of the Plum and Sloe, and that in the month of May they (the *Aphis Humuli*) leave the Plum leaves and betake themselves to the Hop†; and the third states that the Hop Aphis is to be found from July to September in large numbers on the Hop, and that he has seen this on Sloe bushes in May.‡

Our own countryman, Francis Walker, states that the Hop Aphis, the *Aphis* (*Phorodon*) *Humuli*, "migrates in early spring from the Sloe to the Hop plant, and again leaves the Hop in autumn to go back to the Sloe." § The first note is as follows:—

"I have been a Hop grower forty years, and have ever paid great attention to the Hop blight, carrying a magnifying-glass, and many times a day examining the earth round the hills and the plants from top to bottom; also the hedges, bushes, &c., the grass along the hedges, and wherever I could get a clue towards destroying the Aphis before it attacked the Hops.

"I do not think the eggs are deposited in the earth round the hills, as there are never Lice on the plants first, but Fly; the Lice come from the deposit of the Fly.

"The Fly comes from other sources. I have always found them on the Maple, Damson, Sloe, &c., as Lice first, and when they come into Fly they take wing to the Hops, and settle on the tips of the plants, on three or four of the upper joints where the young leaves are tender. They do not get on the bottom of the plants, except the wind blows them off on the ground. The blight attacks the Hops near the above-named trees first, and more severely." — HORACE COLEMAN, Brede, Sussex.

"My experience is, an egg in the first place is deposited on plants such as Plums, Blackthorn, and Willows. Later in the season that

* 'Praktische Insecten Kunde,' Dr. E. L. Taschenberg, part v., p. 50.

† 'Die Pflanzenlause Aphiden,' C. L. Koch, pp. 115, 116.

‡ 'Die Pflanzenfeinde,' J. H. Kaltenbach, p. 534.

§ 'Annals of Nat. Hist.,' xx., p. 209.

deposit brings forth Lice, which after a time turn to Fly, and thus visit the Hop plants. You can generally tell in the spring, several days before an attack on the Hops, whether you are likely to have it." —T. HAMMOND, Fordcombe, Tunbridge Wells.

"The severe attacks are generally foretold by the time of picking in September. When at that time the Lice abound to an enormous extent, the pokes are covered—the pickers' hands are moist with Lice—then the attack is certain in May or June following. Previous to the attack Lice are found on Blackthorn; these Lice turn to Fly (I have seen them). As soon as the Blackthorns are clean Fly cease." —F. ARNOLD, Saint's Hill House, Penshurst.

"It appears that the blight first shows itself on the Blackthorn, then on the Sloes, so by degrees on all forest trees more or less, especially in the Willows, &c., and in such numbers that it is impossible to deal with the insect as a whole."—F. L. HAUSBURG, Edenthal, Penshurst, Kent.

The foregoing observations appear to me to point very strongly to the probability of attack coming on the wing, and from Plum and Sloe; and most careful search made in earth taken from the roots of infested Hop plants has not shown that either in winter or spring eggs or Aphides are lying there.

Eggs or Aphides have not yet been found, either in late autumn or winter, on dead bines, leaves, earth, or root-stocks, or on growing shoots in early spring.

Mr. G. B. Buckton mentions in March, 1883, he received a block of earth containing the root-stock of a Hop plant which had been infested with Fly during the previous year. This he examined carefully, "taking a spoonful at a time, and viewing it under lenses of different magnifying powers," and, he says, "I could not find a trace of either Aphis or eggs."*

EARTH.

My own observations began by careful examination of earth received on November 29th, 1882, sent me from Hop hills known to have been infested by Aphides in the previous season. I kept this (carefully secured) out of doors during the winter, and, on the 19th of March, examined some of the earth: as nothing appeared in the shape of Aphides either then or afterwards, on the 8th of May I turned the contents of the box out and examined the earth with great care, but I did not find either eggs, or Lice, or Fly. My observations were taken both by examining the earth under a lens, and also by putting portions in water so as to detach any light bodies and examine them on the surface. In the course of all this I detected a very few—perhaps four

* 'Brit. Aphides,' by G. B. Buckton, F.R.S., vol. iv., p. 187.

altogether—of what might be eggs, or broken pellicle of eggs, of some insect, but that was all.

In the course of the present autumn I have carefully examined earth from the roots of the Hop mentioned, which had been isolated and severely attacked, but have been unable to find any Aphides or eggs.—Ed.

Dead Bines, Leaves, &c.

With regard to winter harbour of Aphis on the cut bines, dead leaves, or in bark or Hop hills, I can state that I received a bundle of Hop bines from Kingsnorth, Kent, some time previous to November 29th, 1882, and examined pieces of these minutely, but could not detect either eggs or Aphis presence of any kind in any nooks or crannies, nor did any develop in spring.

I also examined the bark of some sets sent me from Detling without finding Aphides or eggs. Some of these leaves I forwarded to Mr. Buckton, who examined them, but similarly did not find Aphis presence.*

The following notes show similar results from observations on the growing plant early in the year (March 21st or 29th) and the earth in August :—

"I have been looking at my Hop hills, but can see nothing; the shoots are about two inches long, and when cut through longways the young leaves can be seen quite plainly about the size of peas, but I can see nothing at the present like egg or Fly or Aphis." †—Richard Cooke, The Croft, Detling, Maidstone.

With regard to the other trees mentioned, as Willow, &c., there is this much to be learnt from it, that the state of the weather which is favourable to Aphis increase on one kind of tree or bush will probably be to another; therefore, if great increase is observed to be going forward, Hops should be looked to. But with regard to the *special* Aphides of another tree infesting Hop, I believe there is no trustworthy entomological record at present of that being the case.

* Perhaps to those who are not acquainted with the great value of the opinion of Mr. Buckton as to species or method of life of Aphides, I should mention that he has devoted many years to the study of their methods of life, and is the greatest English—possibly world-wide—authority on their life-histories, and the author of a long and elaborate work giving figures of all the English species in their different stages.

† In two or three cases of detailed and very good observation of some small insects (supposed to be Hop Aphis in its early stage) being observed going up the stems from the ground, I think that the attack was not Aphis, but of the Hop Frog Fly. The specimens in one case were noted as so small as to be "almost imperceptible"; in another, when forwarded, they proved to be of Frog Fly, "Jumper" (*Euacanthus*, scientifically); and to a non-entomologist these insects, when in their first stage, would look very much alike. I have therefore not given the notes here.

Aphides from Elm, or Lime, or Willow, or Sycamore, may sometimes be *found* on Hop; they may even be seen for two or three days, and may produce young, but, as far as I can learn or have observed myself, these points are merely accidental, and no permanent lodgment is effected. In the course of the present season my own Hop plants were sprinkled with Aphides from neighbouring Elms, but these females produced young equally on the spiders' webs as on the Hops, and all soon passed away. If the Hop Aphis is examined under a pretty strong magnifier it may be known by having tubercles on the forehead, with a tooth on their inner side; *and* also by the first (that is, the lowest) joints of each of the horns being bluntly toothed or gibbous. From this characteristic it takes its present generic name of *Phorodon*, signifying to bear a tooth; and if we could find this Aphis on other trees (as we do on Plum), and as we apparently very likely might on the Nettle, this would be very important.

In the course of June in the past season I received the following note regarding

HOP FLY ON NETTLE.

"June 15th.—I may add that I found some of the same kind of Fly on Nettles close by our Hops.

"June 18th.—I send you some Aphides I have gathered from Nettles. I have examined the large green one, and it appears to me to be the same as the one figured in your Report (see p. 1, fig.). During the day it has given birth to two young ones. There is another with wings, but I think the others are not the Hop Louse."—ARTHUR WARD, The Gardens, Stoke Edith Park, Hereford.

I examined the females and young Aphides forwarded with great care, and could not find that they differed from the Hop Aphis and its young. They are certainly not the Nettle Aphis (*Siphonophora Urticæ*, Kalt.); and it will be observed that Mr. Ward notices seeing two kinds on the Nettle.

It may have been an exceptional case, but still this matter well deserves searching into. The Nettle is so nearly allied to the Hop that it is likely enough on the face of the thing that the Hop Aphis should frequent it; and a remark is also given on this subject at page 8. If the Nettle is a *host*, as well as the Hop, of the Hop Aphis, it would account for borders of gardens being often first attacked, and in any case some experiment as to destroying Nettle beds, which may very likely be winter shelters, would do good.

We do not yet know whether the female Hop Aphis lives through the winter, or whether, as may very likely be the case, she produces eggs in the autumn and dies,—this may vary according to the winter being mild or severe; but just as in the case of the Bean Aphis (which is one of this tribe), we know that, though there may have been no

Bean crop for a long time in a field, yet that from some neighbouring shelter or other there come the females which produce the Colliers; and so it appears with Hops. In the case of the Bean Aphis (for one place) they shelter in Gorse; and if either with Bean or Hop we could find where the shelter *commonly* is, then we could go forward.

The preceding observations give (as far as I can give it at present) the state of the case as regards first appearance of Aphis. As far as these observations go, it appears that the attack is certainly *first observed* on the *upper part of the plant, and in the form of Fly;* and that we have no evidence from the most careful search that the eggs or the Aphides are to be found in autumn, winter, or spring, anywhere about Hop-rubbish or in the earth.

But nevertheless I do not think the point is proved yet, for this reason:—I am aware, though the notes have not been sent in this year, that there have been a *few observations of Lice being first seen.* I noticed that amongst my own Hops, the only plants which escaped attack were a set or two which I had examined so carefully for Louse and egg presence that hardly any earth or shelter remained. Also, though I failed to capture it, I have seen what appeared to me to be the wingless female early in the season on the lowest leaves of a Hop yearly infested in my own garden. Also, though I have not wished to introduce exceptional conditions into this paper, I have a note taken after careful examination by Mr. C. Whitehead, in which he informs me that in a Hop plant which he was growing in a greenhouse the first appearance was certainly of 'Lice.'

This is an important observation, and so is the following:—

Isolation of Hop.

"In answer to your letter respecting the experiment on the Hop covered with muslin, I had the plant covered up early in the season (about the end of May), first of all seeing that the plant was thoroughly clean. I used three poles about nine feet high, placing them triangularly round the plant (the three poles meeting in a point above it). I then tacked the muslin securely to the poles from the bottom to the top, allowing six inches of muslin to be buried in the soil at the bottom to make sure that nothing could get in, except they came directly from the soil. It was simply impossible for anything to get in from the outside, the muslin I used being very fine. The plant continued clean, as I informed you in writing to you once or twice afterwards [it was mentioned up to June 15th as being 'perfectly clean,' Ed.] On examining the plant again I found that there were a good many Fly on the leaves, and also a quantity of wingless Aphides; and later on (on August 9th) these plants that were covered with muslin were

swarming with Aphis from top to bottom, and there was hardly a green leaf to be found.

"On August 16th it was noted:—The Aphides have gone on increasing to such an extent that they have almost killed the plant. The top and under side are smothered with them, and the stems and all the interior of the muslin are full of the dead bodies of the Aphides. Now these Aphides must have come from the ground, for, as I stated before, it was simply impossible for any insect to get in."—ARTHUR WARD, The Gardens, Stoke Edith Park, Hereford.

In the above experiment it will be noticed that the plant was very carefully examined and considered clean at the time of enclosure, and for more than a fortnight afterwards, although subsequently the Aphides appeared in such numbers as nearly to smother the plant. This experiment seems therefore to point in this case to the Aphides coming up from the ground or from crevices in the stock or roots, where in some shape, it may be as eggs, or it may be as females hybernating, they had passed the winter.

It would be a most serviceable thing if this experiment was tried in different localities. It would be no great trouble to put three poles over a Hop-hill, and fix stout muslin so as to stop ingress or egress, and, by setting up the poles early in the year before Hop Aphis was about, or indeed, to make quite sure, before the plants began to grow, there would be no need to watch to be sure of not enclosing Aphis on the plant. If we then found, on the authority of many observers, that the enclosed Hops were attacked, we should have positive proof that a part at least of the attack comes up out of the ground, and the necessary treatment of the soil or Hop-stocks to get rid of the harbouring pest during its quiet state, would very shortly be made out by those most concerned and experienced in Hop growing.

I may add the experiment was undertaken at my request by a thoroughly competent observer, in imitation of the method by which Prof. Riley, State Entomologist, U.S.A., discovered the missing links in the life of the Grape *Phylloxera*.

EFFECTS OF HEALTHY GROWTH.

The following notes refer to the effect of a healthy state of the plant on the non-increase of Aphides:—

"It will be noticed that it is not the point of the healthy Hop growing past attack, which attention is specially drawn to here, but that in *certain states of sap the Aphides do not increase.* This exemption from attack has often been noticed, sometimes in one special locality (as I believe is often the case in the Isle of Thanet), sometimes in the case of what is known as a "lucky" ground or part of a ground, or in the lesser instances of a few hills or a single one.

It would be exceedingly useful if any information could be given as to the cause or causes (as they may be many) of this exemption, such as exposure, temperature, manure, &c.; also whether there was any special presence or absence of woods or hedges, or waste weedy land near. The first note is as follows:—

"I have observed many times a pole or hill keep quite clean when the surrounding hills were infested with blight, and if these bines run on to infested poles there is something about them too healthy to allow the Fly and Lice to get on them.

"I always fancy, when we get these severe attacks of blight, that, although the plant may look rank and strong, there must be something wrong about it, perhaps a lot of unhealthy sap, through excessive wet seasons, so that the plants, earth, and atmosphere may be in a fit state, if not to cause 'blight,' certainly to encourage it. My plan has always been, by extra cultivation and attention, to endeavour to get the plant *healthy*, and I have succeeded so far that I have never been so blighted in any year but that I have got many of my Hop-gardens through. Some of them last year (that is, 1882) looked very beautiful."—Horace Coleman, Brede, Sussex.

"There is a Hop-garden on the Kentish rag near Maidstone: in the early part of this year (1883) the bine was slack, and it was forced on by the application of rape dust, one ton to the acre,—this is a heavy dose. This has produced a young succulent growth, which has been badly attacked by vermin. Grounds near it are practically clean, so that too great forcing is nearly as bad as too severely checking the plant by unfavourable weather," &c.—Richard Cooke, Detling, near Maidstone.

"Hop Aphis usually appears after an ungenial season, when the Hop plant for some reason has become unhealthy, and hence the attack, just as animals which are diseased will be covered and their coats filled with vermin. If the Hop plant can by genial weather resume its healthy state before the Aphis has overpowered it, then the Aphis will leave, and a moderate crop will be grown."—Edward Monckton, Hale Place, East Peckham, Tonbridge.

Washes.

The following notes refer mainly to the benefit and method of application of washes:—

"Last season the only good Hops that could be seen for miles round were in the immediate vicinity of Penshurst, the fact being that the Hop-gardens here are of a limited extent; they are kept clear of weeds, well manured, and when the Aphis appears the plants are washed again and again,—in fact, so long as the insects appear; the farmers are able to find sufficient labour here to do it.

"Where the cultivation is not so careful, or where Hop-gardens are too extensive, and the local labour not sufficient to battle with the evil, then the Hop is destroyed by the Aphis."—F. L. HAUSBURG, Edenthal, Penshurst.

"The washing of Hops is an expensive process, as it comes at a time when the summer work requires to be done, and some must be delayed. I commenced washing this year (1882) about the 2nd of June, and continued for about seven weeks, washing them all every week or eight days.

"I used engines with one hose, one lad to pump, one to direct the hose, and one to carry water, if near at hand; if from a distance this would require a little extra.

"I used 14 gallons of water to 1 lb. of soap, with a little addition of soda, but I am not certain whether the soda was really useful. Some of my neighbours used 10 gallons, some 12, to 1 lb. of soap. I used the best soap, and preferred to use a greater quantity than to be more careful, and not use so much of the wash when made stronger.

"I have gone through all my expenses, and I find the cost, reckoning everything, to be about £8 per acre.

"I put on about 500 gallons of mixture to every acre at each dressing. I consider the soap to be worth something as manure.

"I begin to pick on Monday (Sept. 11th, 1882, ED.). Crop, as I set my average, about 8 cwt. all through. The Colgates are not growing out through the wet and cold, or I should put them a little higher. It is sad to see the great bulk of the plantations: very many grounds will not have a bin put to them."—T. HAMMOND, Fordcombe, Tunbridge Wells.

"June 15th.—I find that but very little Fly has appeared round here. Lady Emily Foley's Hop-yard was attacked about a fortnight ago, only slightly. The Hops were washed at once with soft-soap and water, and I believe the Fly has disappeared.

"I have found the following mixture to answer admirably for syringing or washing the Hops, the effect being to kill the Aphides almost instantaneously, and it does not injure the burr:—For large quantities, 12 lbs. of soft-soap and half a gallon of paraffin to 100 gallons of hot water; to be stirred well together and used when cool. I find paraffin mixes well by using hot water, the nearer boiling the better."—ARTHUR WARD, The Gardens, Stoke Edith Park, Hereford.

"I take but little heed of the winged Aphis, but when followed by Lice and Nits the blight becomes dangerous, and the plant should be washed with soft-soap and water,—9 lbs. of soap to 100 gallons of water I have found most efficacious,—at the same time freely using stimulating manures, ammonia, nitrates, soot, &c.

"The only entire failure of Hop-crop I have had was in 1879, and

this, I believe, was to a certain extent my own fault: I did not persevere with washing and stimulants. Last year I grew 20 tons on 70 acres.* I attribute my success not only to washing and the free use of stimulating manures, but to early cutting.

"I commence this work directly the sap is down, and finish in January. . . . . I find my method ensures an early and strong bine, much more capable of withstanding attack of blight than a late and weak plant. My bine is now (May 25th) three-quarters up the poles, and, with a continuation of favourable weather, will top them in fourteen days.

"If frost will injure the shoots of the plant that is cut early, we should have found it this season, when we had such a continuation of frost all through March."—J. W. Hopkins, Lower Wick, Worcester.

Ladybirds.

Ladybirds. 2, egg, mag.; 3, 4, grub, mag., with nat. size; 7, *Coccinella bipunctata;* 8, *C. dispar;* 9, *C. septempunctata.*

The following notes bear witness to the good done by the Ladybird Beetles and their grubs in destroying Aphides, and also the vast numbers in which these variously-named Beetles and grubs appeared early in the past season.

Care should be taken that these helpers are not destroyed when they appear, as is not unfrequently the case, in such numbers that they lie open to being swept up; and further, as we all know these Ladybirds winter in warm dry shelter, that it would be quite worth while to examine in Hop districts whether any noteworthy quantity of them were to be found in sheds, or amongst heaps of poles or rough wood, or any other shelter near the gardens.

Many insect attacks may be kept down by clearing away such shelters; in the case of the Ladybird it is very possible that the Beetles might be much more preserved than at present by leaving their resorts. Anyway, it would be worth inquiring into.

"June 2nd.—*Coccinella* is now plentiful near Hereford.

"July 2nd.—The 'Collier' is abundant; nearly every Hop plant

has several batches of eggs, as well as larvæ of the *Coccinellæ*. I should not like to say positively that the Aphis is entirely held in check by the Ladybird, but I think the evidence to that effect is strong."—Dr. T. A. CHAPMAN, Hereford.

"The 'Crocodile,' or larva of the Ladybird, is a great enemy to the Hop Aphis; two or three will clear a Hop-stock in a very short time. The Ladybird lays her eggs in beautiful order under the Hop leaves, and, as soon as hatched, the larvæ begin to feed, and shortly clear the Hops of their blight; but unfortunately they do not come soon enough to stop the Fly from breeding and spreading their numerous progeny." —RICHARD HEMING, Cheltenham.

"The 'Fly Goldens' are our best friends; they feast greedily on the Hop Fly. They lie dormant during the winter in our houses, buildings, &c., and are now (May 12th) resuming life again. If we were to watch closely where they go they might direct us where the origin of the blight is to be found."—HORACE COLEMAN, Brede, Sussex.

Ladybirds were very numerous on the inside of the windows of my house near Isleworth for several days previous to April 9th, and a note was likewise sent me from the Kew Observatory, Richmond, of the unusually large number of Ladybirds then to be seen.—ED.

"The Ladybird is well-liked, but disappears (no doubt going into winter quarters) when most wanted towards Hop-picking. The Niggers, that is, the maggot or grub (scientifically, *larva* of the Ladybird Beetle, ED.), appears to be a much greater friend to the farmer; it has a greater appetite."—F. L. HAUSBURG, Edenthal, Penshurst, Kent.

"Last year it was supposed that the Hops on strings were more suffering from blight than on the poles. I believe it was so, and I attribute it to the circumstance of the stiff hill-pole being preferred by the Ladybird and its larva to the twisting, moving strings."—W. GARDNER, Bekesbourne, Kent.

"From the immense number of Fly Goldings about this winter (1882–83) the country people predict a good Hop year; whether (if there is any truth in this) it is that a crop-year generally follows a blight when Ladybirds are likely to be numerous, or whether the Ladybirds, when numerous, really do ensure a crop, I suppose remains to be proved.

"To give an idea of their numbers, I moved a Fitzroy barometer, say 30 in. long by 4 in. wide, and the whole of the back was covered with torpid Fly Goldings. Sometimes the sparrow boards of buildings look quite red from the numbers of these insects wintering under their shelter."—RICHARD COOKE, Detling, near Maidstone.

The preceding few notes cannot be said to give a thorough view of what may be the opinions of many hundred growers. Still, it may be

presumed, as there are communications amongst them from growers in each of the great Hop districts, that if there was any clear belief held of Hop-attack coming in any other way than that mainly reported, it would have been alluded to.

The fact of the first appearance being almost invariably noticed as Fly on the uppermost parts of the plant shows that this is at present the point to which the *remedies* must be applied. With regard to *prevention*, we want more notes. I speak with great submission to the practical knowledge of growers; but, looking at the observations of attack of Fly beginning on the outsides of the grounds, it seems to me that some treatment of the borders of the Hop-gardens might be serviceable, and I beg to suggest whether it is practicable to clear rough ground by hedges, of grass and nettles, and other weeds, amongst which the pest is very likely sheltering. Ploughing, digging, or putting the headland under a killing coat of fresh gas-lime, might do much, and any large Hop-grower who would try the experiment and risk the necessary outlay would be doing a very useful thing.

Plums and Sloes appear to foster the evil; but as it comes where there are no Plums and Sloes near, I certainly think that a portion of the attack is from Aphides sheltering about Nettles or other plants, and that a sweeping application (such as caustic gas-lime), which would kill everything living on or under the surface of the waste ground, might be of great service.

The matter of the absence of the Aphides in some places is a very important one, and so also is the preservation of Ladybirds, as far as it can be managed.

In placing these notes, which I have been favoured with by my contributors, before you, I must first beg some of them to excuse me in not having given the whole of their communications, as the points required here were the mere dry observations; and next to note this *is only a beginning*.

It is only those who understand the matter practically that can work the points forward, and I earnestly trust that observation may be continued and kindly placed for publication again in my hands; and on my part I shall be most happy to give every information that lies in my power to any enquirer.

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REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

AND

COMMON FARM PESTS

DURING THE YEAR 1884,

WITH METHODS OF

PREVENTION AND REMEDY.

EIGHTH REPORT.

BY

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PREFACE.

Before submitting the observations of the past season to the contributors to whose kind assistance I am indebted for the information, I beg to offer my best thanks for their courteous co-operation, and to request its continuance. I wish also to offer my thanks for the assistance cordially rendered by the press.

It will be noticed that the observations have now been extended in some degree to insects affecting cattle and farm stock, and a slight corresponding alteration has been made in the title of the Report.

During the eight years in which our crop insects have been reported on, such full observation has been sent in of some of the regular yearly attacks that it seems to leave but little more to say with regard to these; but there are some points which are shown constantly and plainly still to want attention as the very starting-points of a large part of our yearly attacks, and one of these is treatment of grass and clover-lea before breaking up. Half or more of the ravages of the Wireworm and Daddy Long-legs grubs arise from these being in the land before the new crop is put in, and any notes of treatment to prevent egg-laying, or of applications or treatment to destroy the grubs in breaking up the land, would be very acceptable, as tending to lessen one great source of loss.

Warble Fly injury to our cattle, and Liver Fluke to our sheep, are two other important subjects. On the first I should be greatly obliged for any information and specimens; on the second, though I am not qualified to offer any advice relatively to the Fluke when in the liver of the sheep, yet as much might be done to lessen the amount of this disease by lessening the amount of the Marsh or Pond Snails, in which the Fluke spends the first part of its life, I should esteem it a favour to receive any

information on this head. Figures of Marsh Snail (*Limnæus*) and some observations on this subject are given at pp. 91, 92.

The amount of attention bestowed on the very important subject of insect prevention is showing year by year that the national losses are not by thousands, but by millions, of pounds. The loss in the Hop failure of 1882 was estimated at a million and three-quarters, that from Turnip Fly of 1881 at over half a million pounds sterling; and a perusal of the losses recorded per acre as a regular yearly trouble will show what is going forward. The subject is steadily gaining the attention it deserves, but with this has come such an enormous increase of correspondence that I have made arrangements to enable me more especially to attend to all enquiries, and to communicate with those who may be disposed to note the effects of different treatment, and to report results. I shall feel it a pleasure to give my very best attention to all enquirers, and shall hope, if all be well, to be permitted again to offer the information given to my contributors.

The subject of bird-presence has lately been so much discussed that it seems desirable to add something more to the observations (pp. 5—11), which were in type when the discussion arose. Nobody wishes to destroy the small birds broadcast. We should suffer severely if their presence *generally* was lessened; for instance, there appears to be good reason for considering that the insect-presence in 1879 was more than usual, owing in part to the destruction of birds by the cold of the preceding winter, and the cold wet spring affecting nesting and hatching (see Phenological Report of the Meteorological Society); but, on the other hand, if from special local cause, increase takes place to the great extent which is noted by Mr. Goodwin near Sevenoaks, this may need attention.

With regard to benefit received from many of our common birds, I think it may be of interest to repeat a portion of the information given at p. 38 of my Report for 1879, and to that list it is desirable to add Wagtails, as one or more species is stated to feed on the Marsh Snail, and consequently may help with regard to keeping down the Liver Fluke; see above, in Preface, and also p. 91.

Among the species serviceable generally on forest trees, Apple trees, and fruit trees, the Report mentions the Titmice, including the Blue, Cole, Marsh, Long-tailed, and Great Tit (and of these

the Blue Tit may be specially observed at work among the Aphides on Gooseberry bushes); also the Warblers, Woodpeckers, Nuthatch, and Tree Creepers. The Lesser Spotted Woodpecker is noted as specially frequenting the Apple; the Golden-crested Regulus frequents the Scotch pines, Spruce, and other Coniferæ; the Bearded Tit, Yellow Wagtail, Titlark, Wren, Cuckoo, and Water Rail are mentioned as serviceable in Osier beds and reeds and marsh hay. Among the Gooseberry, Currant, and Raspberry bushes the Titmice and Warblers, the Wren, and the Cuckoo are noticed as of special use. Among Cabbage and Turnip crops the Partridge, Spotted Flycatcher, Swifts, Swallows, and Martins are serviceable. On grass, besides the Warblers, Swallows, Swifts, Martins, and Partridges before mentioned, the Wagtails, Pipits, and Starlings, are all of use. The Cuckoo is of special service from not refusing hairy larvæ, and the Flycatcher as destroying the White Butterflies.

But with regard to the one item of Sparrows, its special habits make this bird an exception to what we may fairly call our regular feathered *friends*, and in confirmation of the observations given in this Report, both as to their driving away other birds and their corn- and seed-feeding propensities, it may be well to draw attention to the observations of Mr. R. Lowe, of Sleaford, printed in my Report for 1883, including a year's observation of their food from examination of their contents and also of their habits, and likewise the opinion of Mr. J. A. Lintner, State Entomologist of New York State, U.S.A., who, while he presses the *importance of preserving insectivorous birds* in his First Report, p. 61, further mentions, amongst remedies for insect-presence, "levying a war of extermination on that unmitigated nuisance, the English Sparrow." To this bird Prof. J. A. Lintner ascribes the increase of various caterpillars, and it is not enough thought of with us (though it is very plainly to be seen) how much this audacious robber drives away the Martins, which, like it, frequent our homesteads, but which *are* exceedingly helpful in destroying over-amount of insects.

The following note is also well worth the attention of those concerned, which is contributed by Mr. A. Molineux, Member of the Committee of Agriculture of the Royal Agricultural and Horticultural Society of South Australia:—

"I have been writing lately on the Sparrow question, and also on the injury to Australian cultivators done by imported pests.

The Sparrows here have driven off nearly all our insectivorous birds, which of course are small, and have generally soft bills and a timid nature; but the Sparrow will eat nothing but seeds, while seeds are available. When there are no seeds they will eat fruit,—when there are no seeds or fruit they will condescend to kitchen vegetables (or zonal pelargoniums); but if none of the foregoing are to be had, and the dog, the pig, and the cows cannot be robbed, the Sparrow will stay his hunger with Aphides or soft grubs and caterpillars."

It is said (and rightly, if we could have it) that we should keep up the natural balance, but it is not possible in all cases to secure this. We are not in a *natural* but a *civilized* state, and, as civilization makes it necessary to destroy a large amount of birds of prey, and likewise to keep the idle lads of our country parishes from trespassing and killing all they come across at haphazard, it is needful that we should in some cases have a *counterbalance*,—a *legal* and *economic*, rather than a natural, balance.

There is no difficulty in doing what is requisite quietly and in due order, and relatively to this being done even in the fence months, so far as birds not included in the schedule of the Bird Protection Act, 1880, and Larks, are concerned, *without any infringement of the law*, or even the slightest expression of approval of illegal proceeding, I give the following reply, received by me from Mr. Gaskell:—"As regards the Act prohibiting the destruction of Wild Birds after the 1st of March, it appears that if an owner or occupier of land gives authority to persons to kill Sparrows or any wild bird not included in the schedule it is lawful and just, and we, the members of the Wirral Farmers' Club, give that authority."

I have not received from any quarter a single trustworthy observation of Sparrows *feeding* regularly on insects; nobody doubts that they can and do *sometimes* take them, in special circumstances; and it may be that, in the words of one of our well-known naturalists, "The Sparrow, like other creatures, adapts itself to circumstances, and in towns where it cannot procure grain it lives on a great variety of food, and destroys a great number of Aphides of various kinds and Cockchafers."

These circumstances, however, *are exceptional*, and do not bear on our flocks and coveys of Sparrows demolishing the harvest; the harm is before our eyes. I can bear witness to it

personally. What the extent is none know better those for whom this Report is especially written, and if they will give me any notes bearing on the subject in either way I shall be most happy to insert all information.

It would be very desirable to have reliable notes, showing amount of acreage attacked in autumn, loss per acre on the crop and amount of damage to stored crop, if appreciable, as to bean stacks, &c., and also whether attacks are increasing in amount yearly.

I beg, as in former years, to offer my thanks to Messrs. Blackie and Son, Glasgow, for the use of many figures. One figure is also retained of those originally lent for the Report by the Proprietors of the 'Gardeners' Chronicle,' and I have added various illustrations drawn from life.

ELEANOR A. ORMEROD,
Hon. Consulting Entomologist of the Royal Agricultural Society of England.

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1885.

NOTES OF OBSERVATIONS

OF

INJURIOUS INSECTS

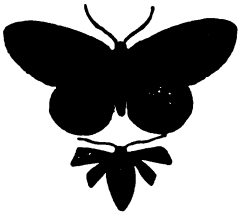
AND

COMMON CROP PESTS

DURING 1884.

APPLE.

Winter Moth. *Cheimatobia brumata*, Steph.



CHEIMATOBIA BRUMATA.

Winter Moth. Male, winged; female, with abortive wings.

IN the winter of 1883–84 experiment on a large scale was set on foot by Mr. W. Charman (gardener to J. G. Strachan, Esq., of Farm Hill Park, Stroud, Glos.), relatively to protection of fruit trees from the attacks of the very destructive caterpillars of the Winter Moth.

One of the common kinds of these so-called Winter Moths is figured above; but the one special point in which several of the kinds resemble each other, and by acting on which their attack may certainly and almost entirely be prevented, is the fact of the female moth having the wings so abortive that they are useless to fly with. Consequently (excepting from accidental circumstances) the females have to make their way to the branches or twigs, on which they lay their eggs, by crawling up the trunks of the trees.

It therefore seemed very likely that smearing the trunks of the trees which had been yearly infested, with some sticky composition, which would catch the moths and hold them fast on their upward journey, could not fail to be of use; and Mr. Charman accordingly began trying this plan in November, 1883, at the time when the female Winter Moths first come from their chrysalids in the ground beneath the infested trees.

On November 10th he mentioned that he had used Davidson's composition, and found it stuck fast everything that touched it, and he had already found a quantity of wingless female moths sticking in the composition at the base of the trees.

On December 11th Mr. Charman reported he had caught upwards of 500 of the females, and the attempt at progress up the trees was still going on. The method of application was to paint the stem *round* for the breadth of one or two feet with a band of Davidson's composition, and go round sometimes (in a morning or occasionally) and scrape off the moths which had been caught. As these moths lay a large number of eggs, the destruction of each female materially lessens the number of caterpillars.

The above first half of the experiment was noted in my Report for 1883, but its full success could not be seen until the following May or early summer, when the "looper" caterpillars from the winter eggs appear. These caterpillars had been noted as being in such numbers on the attacked trees for the previous two or three years that blossom and leaves had both been destroyed; but the above method of stopping the moths from getting at the boughs proved highly successful in preventing the mischief happening again.

Mr. Charman reported this year (1884) that, "with reference to the Winter Moth, the fruit trees treated with Davidson's composition *were free from attack*, with few exceptions. I found a few caterpillars on several trees, but not in sufficient numbers to cause any annoyance. I account for their presence from the fact of there being a belt of deciduous trees immediately outside the garden wall, which were badly infested with Winter Moths; and I think the moths may have been blown from these on to the fruit trees, and thus escaped the composition.

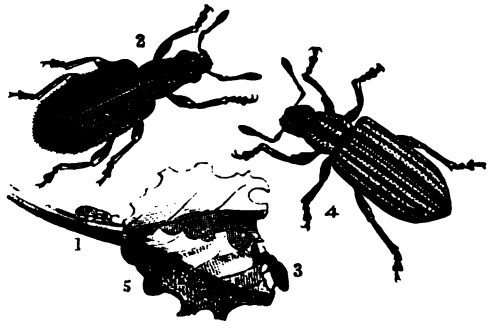
"I have again painted the stems of all the fruit trees previous to the 1st of November (date of letter Nov. 21st), and I have found a few moths attached to the composition. I may say I do not find the composition at all injurious to the trees."

The above method of treatment is well worth consideration to save attack in fruit orchards where the green "looper" caterpillars are at times (and not at all unfrequently) utterly destructive to the young leaves, blossoms, and all, in fact, that they can eat; and, as these

caterpillars attack deciduous forest trees also, it might in some cases be desirable to make the same application, either where there are some special reasons for saving the leafage of the trees, or where, as above, attack from the forest trees might spread to others. The female moths may possibly, as suggested, be blown by the wind from neighbouring trees, but it is also very likely that the winged male moth may, during the pairing time, be the means of transporting the wingless female from one tree to another.

BEANS.

Pea, Bean, and Clover Weevils. *Sitona lineata*, Linn.; *S. puncticollis* (and other species).



SITONA CRINITA AND S. LINEATA.

1 and 2, *S. crinita;* 3 and 4, *S. lineata* (nat. size and mag.); 5, leaf notched by weevils.

Notes have been given in previous Reports of the habits of these destructive beetles, commonly known as Pea and Bean Weevils, though the mischief done by them to Clover is fully as great as to the other crops.

In 1882 and 1883 the life-history of the *S. lineata* in Peas and that of the *S. puncticollis* in Clover, which were previously unknown, were respectively given by Mr. T. H. Hart and Mr. R. W. Christy, and the severe injury to the crop roots by means of the small, white, legless maggots, as well as that to the leafage by the gnawing of the beetles above ground, was thoroughly shown.

Various means of lessening the damage were given in accompanying and previous Reports, though much more information is wanted, especially notes of *autumn treatment of stubbles* to prevent the weevils, which are frequently to be found in hordes and legions on the reapers, in the Pea waggons, &c., at harvest time, and which appear to have excellent

use of their wings, establishing new attack. This takes place partly by some of the weevils going down stubble-stems for the winter, partly by others laying eggs which produce the "white maggots" presently found causing damage at roots of Clover.

Mr. D. Turvill, of West Worldham, notes:—"I have to make a grave charge against the Pea Weevil. It does immense damage to young *Trifolium* plants, clearing them off completely in a day or two. Like the Turnip Fly, its wings render it a lively and difficult enemy to subdue."

The only other notes sent in this year relate to the presence of Starlings on infested crops; also the following observation, sent by Mr. Goodwin, of Winfield House, near Sevenoaks, which gives a convenient method of lessening amount of attack on Broad Beans in garden growth, and again draws attention to the importance of hearty growth in carrying plants through temporary attack.

Mr. Goodwin notes that in many gardens these weevils almost destroy the crop if their habits are not understood, especially if the weather at the time is against the rapid growth of the Bean:—"The harm the beetle does is by continually nibbling the edges of the leaf [see figure], thus seriously checking the plant. As many as six may be found on one plant, and they begin operations *almost as soon as the Beans are above ground.* They are most active in still sunny weather, and, if you approach at all incautiously, immediately drop perpendicularly to the ground, and lie still, as if dead, till the danger is past. Nothing applied to them or the plant is of any use, as the weevils are very hard.

"The only way I can keep them under in gardens is to lay the hand flat, and, separating two of the fingers, let the stalk of the Broad Bean pass between them. This, if done very quietly, will cause some of them to drop, and, the hand being extended, will catch those that fall, whilst the other hand picks them out of the turned-back edges of the leaves, where they drop or creep on being disturbed."

With regard to the appearance of Starlings in large numbers in insect-infested Pea-fields, Mr. Hart, writing from Park Farm, Kingsnorth, Kent, observed that the weevil began to commit serious damage, and, although the Peas grew away from this attack, Aphis followed, and "Starlings by hundreds frequented the Pea-fields, as also did numerous kinds of smaller insectivorous birds, *but not the Sparrow, until the Pea was large enough for him to peck it out of the pod.*"

Col. C. Russell, writing from Stubbers, Romford, in July, mentioned, "Starlings frequent fields of Green Peas in flocks": the neighbour, on whose ground they were then observed, failed to

shoot a Starling for examination, but large quantities of weevils (of which specimens were sent) were found in the waggon which carried the Peas, and it was thought the Starlings were after these beetles.

These flights of Starlings appear to be good examples of the kind of bird-presence that *is* useful. The insects come in great numbers, and the birds come from all about for a short time, presumably to feed on them, for if they fed on the Peas the ravage would be very plain to be seen. When the attraction is gone, so also will the concourse of Starlings go also; and whilst it appears to me that on the one hand there is no occasion to encourage them by artificial protection so as to injure reed-beds, or do other damage by their numbers, on the other hand it would be highly undesirable to destroy them or frighten them away.

BEET.

(See MANGOLD.)

BIRDS.

DEPREDATIONS OF SPARROWS.

The subject of the great loss caused by Sparrows still needs to be brought forward. The injury continues to be widespread and serious, not only with regard to corn, but likewise in fruit farming districts, and to garden crops; and to encourage those who are suffering under it to bestir themselves actively in getting rid of the pest, it is desirable to draw attention to some points connected with it which deserve consideration, such as what the food of the Sparrow is during the whole year besides the corn which we see it robbing us of; what its habits are; and likewise whether, where Sparrows have been destroyed during a series of years in any given area, that area has been infested *with more insects*, or *with more of any special kind of insect*, than when the Sparrows were there.

In this matter we refer (with one exception) to the House Sparrow, the *Passer domesticus*, and do not in any way mix with the subject considerations of other "small birds."

During the past season I have received communications from observers, of which I give a few to show that in counties far apart from each other the mischief is still continuing both to food-producing crops and likewise to the produce itself. I have also received communications regarding food found in the Sparrows' crops or gizzards,

but it does not appear to me with regard to this point that a few observations taken here and there, or even for several months at a time, can give a safe basis to rest on. Therefore (by his courteous permission) I have placed myself in communication with Lieut.-Col. Russell, J.P., D.L., of Stubbers, near Romford, whose thorough investigations during a long course of years into the habits of this bird enable him to furnish us with the details that we want.

Col. Russell gave evidence some ten years ago to a Committee of the House of Commons relatively to this bird. He has since then continued his observations, and, from the various documents which he has been good enough to place in my hands, I give (at pp. 7–9) some portions showing the results of his examinations, and also of his observations and experiments for upwards of twelve years. These, it will be seen, give not only his personal observations, but also bring forward many points—open to all to judge of—by which agriculturists and other sufferers may *prove for themselves* the *inaccuracy* of the arguments often used by those who urge the protection and preservation of these legions of devourers.

Firstly, however, with regard to a few of the observations sent in during this season, the Hon. Cecil Parker, writing from the Eaton Estate Office, Eccleston, Cheshire, on July 19th, remarked:—"The Sparrows are doing an enormous amount of damage. One of our tenants informed me that they began at his wheat before it was out of bloom, and, not content with that growing on the headland, they were attacking that growing in the middle of the field. They are also doing a considerable amount of damage to our wheat."

Mr. Reginald Christy, Boynton Hall, near Chelmsford, who is well qualified to form an opinion on the subject of bird-injury to crops, writes me:—"I can heartily endorse the views of Mr. R. Lowe* with regard to Sparrows, so much so that, all other remedies having failed, I am obliged to poison them. I have examined the contents of a great many at different times, and have invariably found corn and no insects."

The following communication is from Mr. T. H. Hart, of Park Farm, near Kingsnorth, Kent:—

"In my opinion the Sparrow is most decidedly our enemy. He begins in the spring by eating the tender heads of my Peas as they appear above the surface, then extends his depredations to my beds of Radish, Lettuce, Cabbage, and similar seeds. Next the early Pea-pods are robbed of their contents. Later on he turns his attention to Currants, Gooseberries, Raspberries, Cherries, Plums, and even sweet early Apples. During nesting-time a caterpillar is occasionally given

* Report for 1883, p. 41, depredations of Sparrows as shown by examination of their contents.

to the young ones, but is, in my opinion, by no means a staple article of diet. If it were so the *great numbers of Sparrows often seen about farm-buildings would soon strip the garden fruit trees and farm crops of the superabundance of insects;* but the fact that crops are repeatedly destroyed by insects in one state or another where Sparrows abound is sufficient proof to me that they are not our friends. As soon as the grains of corn begin to swell and become milky, the Sparrows flock to the fields and commit such havoc as alone is enough to make the farmer demand their extermination. It is not what they eat so much as what they destroy that is so annoying.

"I took measures last spring to reduce their numbers about my farm, and I think with very beneficial results."

Mr. W. J. Goodwin, writing from Crouch, near Sevenoaks, expresses satisfaction at the bird question being opened, as it has been stated that the numbers of small birds are decreasing, whereas the numbers are alarmingly on the increase; and in the parish of Mereworth and others some acres of Currants and Gooseberries have had to be grubbed up solely in consequence of Sparrows, Linnets, and Chaffinches plucking out the buds and the insides of the blossoms. "Boys and men have to be employed with guns and rattles to get any fruit produced at all. I can refer you to a dozen of the largest fruit growers in Kent in support of the statement.

"It is thought to be principally occasioned by the birds being too dense, and thus not getting enough of their usual food."

The destruction of buds by small birds is often stated to be with a view of getting at small caterpillars or grubs within, which it is also stated (in a general way) would have destroyed the buds even if the bird had not taken them. On this point there may be a good deal of doubt, and I can say from my own experiment that, having had my Gooseberry bushes greatly injured, especially in 1883, by the buds being taken, that this year (that is in the spring of 1884) I had them well covered with lines of white wool. In consequence of this the birds let the buds alone, and a magnificent crop of Gooseberries and good foliage on the bushes followed.

The following observations by Col. Russell convey so much plain information, together with sound reasoning that all may prove for themselves, that I give extracts at some length as meeting many of our difficulties, and placing the subject in a clear light* :—

"The question whether Sparrows are useful to the farmer is easily decided; they *never go far* from houses and roads into the fields except at certain times of the year for the sole purpose of eating the corn, as may be proved by examining the contents of their crops.

* The extracts were taken mainly from a paper read by Col. Russell before the Essex Field Club in 1882.

"If they did any good to the farmer at all the land near their haunts would be worth more to cultivate than the enormously greater extent of ground, where they never take an insect. But this is not the case; the well-known ravages they commit on the grain, especially when it begins to form in the ear, are the only noticeable effects produced by Sparrows near villages, houses, and roads.

"Sparrows also do much mischief in gardens by feeding off young Peas, Lettuces, &c., eating Green Peas from the pod, *stripping Gooseberry bushes of their fruit-buds.*

"The question remains whether they do good enough in gardens to make up for such misdeeds there.

"For some years I carefully investigated the question of Sparrows' food, examining that taken out of thousands, *old and young, killed at all sorts of times and places.* The general result was that the old ones contained *little else but corn, rarely* an insect. The young ones are fed with a great variety of food: corn, green and ripe, Green Peas, insects, &c. *At least* 95 *per cent. of a Sparrow's food during its whole life seems to be corn.*"

Further, Col. Russell points out "that to prove Sparrows are really useful, it is not enough to show that *they destroy some insects*, but it must also be shown that *in their absence other birds would not* destroy them as effectively."

This point appears to me very important, for it is often vaguely objected what mischief there would be if the Sparrows were not at hand, a confusion which seems to arise from quite disregarding that in the discussion we are not using the word "Sparrow" as a general term for all small birds, but simply for the one special and almost intolerable pest, the *Passer domesticus.*

Col. Russell continues:—"My object in letting no Sparrows live anywhere near my house has been partly to get a better practical test of their utility than any amount of examination of food in their crops. Sparrows having been *almost* absent from my place for years, *if* they took insects which other birds will not, such insects would increase, and the Sparrows killed there would show this. Now it has been quite as unusual to find an insect in an old Sparrow there as elsewhere.

"In fifty of all ages, from the time *they first feed themselves*, killed *there* one summer with food in their crops,—*this consisted of corn, milky, green, and ripe, and sometimes Green Peas,—only two small insects were found in the whole number.*

"With old ones, however, *eating few insects anywhere*, this was not test enough; but *if any insects were the peculiar prey of Sparrows*, and had increased, any *nestlings* there should be full of them. A pair or two of Sparrows have therefore generally been allowed to have a nest

in or near my garden, and nearly every year young ones have been taken there, and the food in them carefully examined with a lens. It varied greatly, but certainly *there were not* more insects, if as many, as where Sparrows abound. *Of caterpillars supposed* to be kept down by Sparrows, *only two small ones, and those in callow birds, have been found during the twelve years.*

"On the whole the deduction from these tests, so far as they go, seems to be that the insects given to their young by the Sparrows (they were allowed to live in numbers about my premises) would be so much food taken, when they most want it, from better birds which live entirely or nearly so, on insects, and thus (where not displaced by those 'parasites on civilization,' the Sparrows) keep down the insects more effectively than the latter."

Col. Russell further mentions that after the almost total absence of Sparrows from his garden, "everything seems to do as well as elsewhere, many things better"; and he especially instances that the young Peas need no protection from birds, the Green Peas are not picked out of their shells, and the Gooseberry buds are not picked off.

The above observations appear to me to contain an enormous quantity of practical, valuable information; and the point of the Sparrows driving away Martins, which are certainly insect-eating birds, deserves consideration also.

If those who consider (as I certainly do) that the Sparrows should be diminished would look to the matter in good time, and clear out nests from *their own* outhouses, open stables, ivied walls, and the countless nooks which the Sparrows are so dexterous in finding out to multiply in, they might diminish the numbers wonderfully; and if they could *destroy the old birds at the same time I would advise them to do it*, without heed to the false sentiment which may stigmatise the act as barbarous.

No man or woman of proper feeling would willingly give pain to any living thing, but the lives of the lower animals have constantly to be sacrificed for our own support, and to allow the birds of the air, by ravaging the corn-fields, to carry off the daily bread we have worked so hard to grow is (to my thinking) contrary alike to all principles of religion and of common sense.

Another difficulty sometimes brought forward is that the Sparrows are supposed to be protected by the "Wild Birds Protection Act," 1880, 43 and 44 Vict., in which (paragraph 2) it is enacted that "*the words 'wild birds' shall, for the purposes of this Act, be deemed to mean all wild birds.*"

This point, however, is met, for practical use, by the provision in paragraph 3, where, after specification of penalties for infringement of the Act, it is further stated, in the last sentence, as follows:—"This

section shall not apply to the owner or occupier of any land, or to any person authorised by the owner or occupier of any land, killing or taking any wild bird on such land *not included in the schedule* hereto annexed."

This, it will be noticed, permits all occupiers to destroy their Sparrows (*they not being* included in the Schedule of Birds and the amendment of the same, which I give annexed), and likewise throws no difficulty in authorising others—*i. e.*, telling the lads about the place—to clear them. The fenced times when this authority is necessary is "between the first day of March and the first day of August"; and therefore there is no restriction on destroying the autumn flocks by any means in our power.

With regard to most of our birds, they fill their place serviceably, and, unless from some cause there is an overwhelming increase in one locality, their presence is desirable. But, with regard to the Sparrows, *we see* the harm they do; and the long notes I have given on the authority of Col. Russell (than which I believe we can have no better evidence) show us that their absence was not followed by increase of insect-injury; and we know also the troubles that have followed on the introduction of the English Sparrow in Australia, in New Zealand, and in North America.

It appears to me that there is no doubt—1st, of the injury we are suffering; 2nd, that by a good watch for the nests we might greatly reduce the numbers; 3rd, that we are in no way hindered in doing this or lessening the number of our Sparrows in a regular and proper manner by the "Wild Birds Protection Act."

Wild Birds Protection Act 1880 (43 and 44 Vict.).

Schedule.

American Quail
Auk
Avocet
Bee-eater
Bittern
Bonxie
Colin
Cornish Chough
Coulterneb
Cuckoo
Curlew
Diver
Dotterel
Dunbird
Dunlin
Eider Duck
Fern Owl
Fulmar
Gannet
Goatsucker
Godwit
Goldfinch
Grebe
Greenshank
Guillemot
Gull (except Black-backed Gull)
Hoopoe
Kingfisher
Kittiwake
Lapwing
Loon
Mallard
Marrot
Merganser
Murre
Night Hawk
Nightingale
Nightjar
Oriole
Owl
Oxbird
Oystercatcher
Peewit
Petrel
Phalarope
Plover
Ploverspage
Pochard
Puffin
Purre

Razorbill	Sheldrake	Teal
Redshank	Shoveller	Tern
Reeve or Ruff	Skua	Thick-knee
Roller	Smew	Tystey
Sanderling	Snipe	Whaup
Sandpiper	Solan Goose	Whimbrel
Scout	Spoonbill	Widgeon
Sealark	Stint	Wild Duck
Seamew	Stone Curlew	Willock
Sea Parrot	Stonehatch	Woodcock
Sea Swallow	Summer Snipe	Woodpecker
Shearwater	Tarrock	

By the "Act to explain the Wild Birds Protection Act," 1880 [August 22nd, 1881], the Lark is added to the above list of protected birds.

Whilst the above paper was in type, before printing off, I received the following communication from Mr. E. J. Gaskell, Secretary of the Wirrall Farmers' Club, Birkenhead, which conveys such solid information that I have much pleasure in inserting it. It will be noticed that the damage caused by Sparrows was estimated by the judges of the farm crops to be *one-third* in some districts, and the details given of the plan acted on for lessening the numbers of these terrible crop-pests may be a help and encouragement to work in other districts.

Mr. Gaskell, writing on December 13th, mentions:—"Some months ago you wrote asking for information respecting Sparrows so as to help with your Annual Report. I can now explain how I acted in our district. I sent a note to a suitable farmer, or other person interested in each township, asking them to act as paymaster, which they did, and for the summer months and autumn, till the end of September, we gave 3d. per dozen for old or young Sparrows or their eggs.

"We are now giving 6d. per dozen till the end of March. We had a settling-day on Tuesday last, and in most cases the paymaster had received subscriptions towards the expense from their neighbours, some handing me a balance over what they had paid, so that the Club was very little out of pocket; and we have had thousands killed, and hope to have a tremendous quantity killed this winter, it being the best time to get at them, as they are mostly about the homesteads and stacks at night.

NOTE.—For further observations on Sparrows, and likewise on full attention to the requirements of the Bird-protection Acts being duly given, see Preface.—E. A. O.

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American Quail	Fulmar	Merganser
Auk	Gannet	Murre
Avocet	Goatsucker	Night Hawk
Bee-eater	Godwit	Nightingale
Bittern	Goldfinch	Nightjar
Bonxie	Grebe	Oriole
Colin	Greenshank	Owl
Cornish Chough	Guillemot	Oxbird

Razorbill	Sheldrake	Teal
Redshank	Shoveller	Tern
Reeve or Ruff	Skua	Thick-knee
Roller	Smew	Tystey
Sanderling	Snipe	Whaup
Sandpiper	Solan Goose	Whimbrel
Scout	Spoonbill	Widgeon
Sealark	Stint	Wild Duck
Seamew	Stone Curlew	Willock
Sea Parrot	Stonehatch	Woodcock
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"We all think them very destructive, more so than any other birds, as they are more difficult to frighten, being so domesticated; and we think they can be well spared. The judges of our farm crops estimated the damage done by Sparrows to be one-third in some districts they judged crops in.

"If all Sparrows were killed, there are plenty of useful and harmless birds left to benefit us."

CABBAGE.

Ichneumon Fly of Large Cabbage Butterfly. *Microgaster glomeratus*, Linn.

PIERIS BRASSICÆ.

1—4, Large White Cabbage Butterfly, eggs, caterpillar, and chrysalis.

In the course of October Mr. Ralph Lowe forwarded, from Sleaford, Lincolnshire, a number of clusters of the small yellow silken cocoons of the *Microgaster glomeratus*, the Parasite Ichneumon Fly of which the maggots feed within the caterpillars of the Large Cabbage Butterfly, and which were then to be found in unusually large numbers on some walls near Cabbage grounds in that neighbourhood.

These minute, somewhat wasp-shaped, flies are one of our best checks on the increase of the Large Cabbage Butterfly. The female Ichneumon inserts a large number of eggs, sometimes upwards of sixty, in one caterpillar, where they hatch, and within which they feed, avoiding the consumption of the parts necessary to the life of their host, which may often be picked out from uninfested caterpillars by its larger size, consequent on the number of maggots within it. When these are full-fed (which appears to be usually at the time their live host should have turned to the chrysalis state) the Ichneumon maggots make their way out of it, and spin small yellow silken cases about the eighth of an inch long, which are commonly found in clusters, like masses of minute silkworm cocoons, near the body of the Cabbage caterpillar, which has died from exhaustion instead of turning to chrysalis.

Ichneumon Flies (see Curtis's 'Farm Insects') have been seen coming out in May from cocoons spun in the previous September.

These little flies are only about the twelfth of an inch long, and hardly a quarter of an inch in the spread of their wings. The colour mainly black, legs bright ochre varied with black and brown, and the four wings transparent and iridescent.*

The attack reported by Mr. Lowe from Sleaford appears to have been partial, for on October 14th it was noticed that in many plots and gardens where Cauliflower and Broccoli leaves had been eaten to skeletons by Cabbage caterpillars no signs of the parasites were to be found; and at the same date the infested caterpillars, regarding which I was in correspondence, were reported to be continuing their migration, seeking for suitable winter quarters in which to change to chrysalids. Many had gone up buildings, leaving parasite cocoons at intervals on the walls, and some also up a brick wall ten feet high, leaving parasites on the inner side. Of these Mr. Lowe sent me fine clusters, with destroyed caterpillars lying in the masses of cocoons.

When the Cabbage caterpillar is going to turn to chrysalis it leaves the food-plant and creeps to any dry and sheltered spot, as under rafters, or boards in sheds, or under eaves or coping-stones, &c., out of doors, and the quantity of cocoons of the parasitic maggots found on the walls would be those that had come out of the Cabbage caterpillars on their journey to find a spot which their tenants prevented them needing.

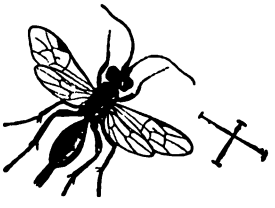
When cocoons are found in these large numbers they should *not* be destroyed, and, if necessary to sweep them down, it would be well to throw them aside safely in an open shed, where the flies might develop in spring and be of service in checking caterpillar-attack.

CARROT.

Carrot Aphis, or Green Fly. ? *Aphis papaveris*, Fab.; ? *Aphis carotæ*, Koch.

On June 16th Mr. W. W. Glenny reported, from Barking, Essex:—"The Green Fly is doing grievous damage among the Carrots; the leaves are curled and look unthrifty. It is doubtful whether, even

* The accompanying figure of *Hemiteles melanarius* (magnified, with lines showing natural size) represents another kind of Ichneumon Fly, which preys similarly on the chrysalids of the Green-veined Cabbage Butterfly. It differs in some respects from the *Microgaster*, which has the "ovipositor concealed beneath the abdomen," but gives a general idea of the appearance of an Ichneumon Fly.



with genial showers, the plant will rally from the attack of the numerous parasites.*

"My first impression was to plough up the plot of about two acres. My salesman advised patience, and to hoe the piece again. After an interval of ten days the improvement is not marked.

"Do we trace these and similar epidemics to the long prevalence of east wind in the spring? The growth of the plants is checked, and the insects apparently redouble their efforts, and stifle the crop in its infancy."

This remark of Mr. Glenny's is well worth attention, for it gives, as a practical and field observation, the important point of checked sap acting in hastening Aphis-development, which Mr. G. Buckton drew attention to scientifically and experimentally some years ago.

I give the passages at length:—

"The addition of wings to the viviparous females obviously must much facilitate the spread of each species. This modification of form does not occur at fixed or stated intervals, but appears to be in some measure induced by an overcrowded state of the colony, and with a deficiency of food. Gardeners are well aware of the sickly and poisoned conditions produced in those plants which are subjected to the exhausting and irritating attacks of Aphides. When the nutritive juices of the infested plants begin to fail a change commences in the larvæ of those Aphides which are subsequently born. Swellings occur on the sides of the meso- and meta-thorax, within which the wings of the future imago are developed. . . . . I have repeatedly observed the effect of stinted food in hastening the development of wings, whilst keeping the larvæ in confinement under bell-glasses.

"Some naturalists have thought that the often sudden appearance of swarms of winged *Aphides* in early spring may be caused by the action of the nipping easterly winds, which, by checking the flow of sap in the vegetation, remotely produces the same effect on the insects as the stinted food above noticed. To this atmospheric condition, which is usually accompanied by insect swarms and a peculiar haze, the popular voice gives the name of blight. Similar conditions of food and climate probably operate to produce the second large migratory flights of early autumn."†

The above views, which seem to me very much borne out by what we constantly observe, namely, that the checked growth caused by bad attack of Aphides is favourable to their rapid increase, points to the special benefit of washes which may kill the Aphis as fly or louse on the leafage, and likewise, by falling round the plants, may

* "Lettuces are also suffering from the same enemies, and they are difficult to clean, and consequently unsaleable."

† 'Brit. Aphides,' by G. B. Buckton, F.R.S., vol. i., pp. 72, 73.

act to some extent as a stimulating watering in driving on growth heartily.

Soft-soap is the best material that we know for the foundation of an Aphis-wash, as it acts as a fertiliser at the roots, besides being an insecticide. For this purpose it is (as has been mentioned before) particularly useful by reason of it adhering to the insects, from which mere watery washes, unmixed with sticky material, slip off without necessarily injuring them, unless they are in clusters where the wash can lodge.

The soap-wash can be used as a method of applying any insect poison thought desirable,—quassia, for instance,—or, with due care, it is very likely that the mixtures of paraffin mentioned under "Mangold-leaf Maggot" (and referred to in the Index under the heads of "Emulsion," "Paraffin," and Wash), might be of much service.

The great difficulty is how to apply the wash or watering to the root-cultivation at a paying rate on the broad scale of field labour. But, so far as an acre or two of land goes, where water is at hand or can be carted from neighbouring supply, if on experiment it was found the mixture was useful, the expense of applying the wash by hand-power from watering-cans would be a far less loss than that of the crop.

CELERY.

For detailed account of severe attack of caterpillars of *Agrotis segetum*, commonly known as the Dart Moth or Turnip Moth, in a Celery ground, see paper on Turnip Moth and references in Index.

CORN AND GRASS.

Antler Moth, or Grass Moth. *Charæas graminis*, Stephens; *Cerapteryx graminis*, Curtis.

On the 18th of June Col. Picton Turbervill, of Ewenny Priory, Bridgend, Glamorganshire, wrote:—"I forward you a local paper with an account of the appearance of caterpillars in large numbers in the mineral district of this county.

"In Bridgend to-day a tradesman, Mr. W. Williams, told me there were vast numbers on a farm on the hills not far distant, and (as I am

going abroad in two or three days) I asked him to procure some and send them to you."

Specimens were forwarded directly after, which agreed so precisely with caterpillars of the Antler Moth, *Charæas graminis*, which were forwarded to me in 1881, when there was a somewhat similar outburst of this kind of caterpillar at Clitheroe, in Lancashire, that I consider the Glamorganshire attack was also caused by this kind, although, looking at the great extent of country over which the ravages of the caterpillars extended, it is impossible to say whether other kinds may not have been present also.

CHARÆAS GRAMINIS.
Antler Moth and caterpillars.

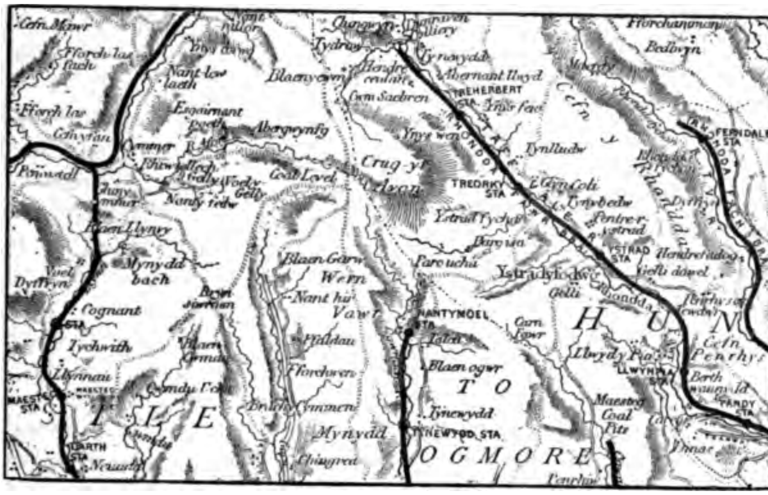
The above figure gives the size and method of marking of the Antler Moth and caterpillar. With regard to colour, the moths are variable, but may be generally described as having the fore wings of various tints of brown, with somewhat pale or white antler-shaped markings, from which the moth takes its name. The hind wings are brown or greyish brown.

The caterpillars are marked with dark brown and pale streaks running lengthwise; the head is brown or yellowish. The life-history is stated to be that the eggs are laid by the female moths about the middle of the summer; these hatch in about three weeks, and the caterpillars are then said to hide themselves by day and feed by night they live through the winter, and in spring again begin their destructive operations. These continue till about June, when they go down into the ground to turn to chrysalids, from which the moths come out to lay the eggs, as above mentioned, in July and August.

To those unacquainted with the habits of this kind of caterpillar, the enormous numbers in which they sometimes swarm over large tracts appear as alarming as they are unaccountable; but this great visitation in S. Wales does not differ in any point excepting the very large area attacked from various appearances recorded before in this country, as, for instance, the one which will be remembered as occurring at Clitheroe, Lancashire, in 1881, and a great appearance on Skiddaw about 1824, also on the Hartz Mountains of Germany in 1816 and 1817; and the devastating power is the same which made

Linnæus describe this grass pest as "the most destructive of Swedish caterpillars, laying waste our meadows, and annihilating our crops of hay."

The localities usually attacked are grass in mountainous districts, and the accompanying map will show the mountain ground and large area over which last summer's attack extended in Glamorganshire.



District of Glamorganshire attacked by caterpillars of Antler Moth (Photo etched from Cruchley's Tourist's Map).

Scale of English miles. 1 2 3 4 5

The north-east side of the Rhondda Valley, which is the most easterly limit named, lies some ten or twelve miles N.N.E. of Bridgend, and it will be observed from the following account that the attack extended thence westward past the Ogmore Valley and the Garw River to Maesteg, the most westerly limit named, and that the large extent over which the smoke of the mountain fires was seen showed the caterpillar-presence spread widely on a scale requiring strong measures to check it. Altogether the area of the attack taking the diameter from W. to E. does not appear to have been less than ten miles.

The account forwarded to me on the 18th of June mentioned that on the mountains of Ystrath-y-Fodwg (hills about ten miles north of Bridgend, in Glamorganshire) myriads of caterpillars were devouring every green thing, leaving the mountains brown behind them.

It seems they were first noticed on Bwlch-y-Clawdd, a lofty ridge separating Cwm Park from the Rhondda Valley; but on Sunday (the 15th of June) it was found that they had attacked, or rather were attacking, also the north-east as well as the west side of the valley. At Treorky Station (a station on the Rhondda branch of the Cardiff

and Merthyr Railway) the mountain brook running from the Fforch Mountains was thick with myriads of these caterpillars, which had been drowned by falling into it during their march across the side of the mountains. The Ystrad side of the Bwlch-y-Clawdd Mountains above Cwm Park were "brown, as the result of recent fires ignited with a view to destroy the pests." Near the summit the insects were observed, which moved down to the mountain-path from the burnt herbage with extraordinary rapidity. Some of them were secured, and (as above mentioned) specimens from the hordes were sent to myself for examination.

On proceeding some miles towards Maisteg, leaving the Ogmore and Garw Valleys on the left, everywhere caterpillars were swarming, and a large hole in the peat was observed in which thousands of the caterpillars had fallen and died. The Maindy and Bwllfa Mountains were alive with them, and, standing on the ridge above the Ogmore Valley, the smoke of the mountain fires was to be seen to the west, where attempts were being made to destroy the pests.

Further details are given in this and in other accounts, of which the main points are—the great area attacked and the damage done; the necessity of burning the surface to destroy or drive away the caterpillars, and likewise the vast numbers found drowned where there was water to fall into; and also the quantities of rooks or crows which flocked to the infested area.

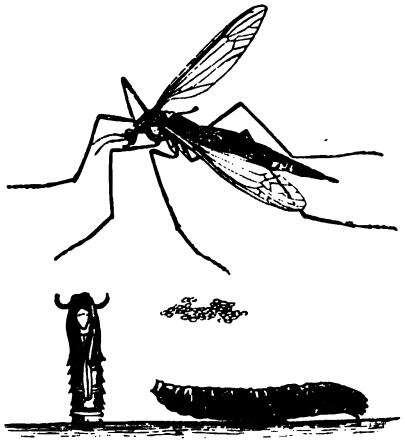
All these points coincide with what has been reported of similar attacks elsewhere, but, as I am not aware of the geographical area of an attack ever having been so minutely recorded, I have thought it desirable to give it at length, with a map accompanying.

The only available remedy for attack on this vast scale appears to be the one made use of, namely, firing the surface, and thus getting rid of great numbers of the caterpillars amongst the burning grass and heath, and other mountain plants which would help to feed the fire.

The habit of the caterpillars of going right onwards, whether into streams, standing water, or otherwise, together with their activity in crawling in bodies away from the fired ground, might very possibly be utilised to direct the course of some of the hordes into a stream or other convenient end.

On a moderate scale of attack it has been found to answer to turn pigs on the infested land, or plough the surface to turn the grass roots up with the caterpillars amongst them for the pigs to clear.

Daddy Longlegs. *Tipula oleracea*, Linn. (and other species).



TIPULA OLERACEA.
Daddy Longlegs, eggs, grub, and chrysalis.

1884 has been marked by severe attack of grubs of the Daddy Longlegs. The large number of the flies which had been noticeable in many localities in the previous autumn gave sign of what was to be expected, and the steady course in which the attack came on is worth notice, as this is one of the kinds of attack in which (unless measures are taken to obviate it) the presence of the injurious insect may be pretty surely forotold.

With such of our crop insects as hybernate—that is, pass the winter in a torpid condition—a mild or variable winter may be rather a means of destroying them than otherwise, for the warmth brings them out from their shelters, as we see with Turnip Fly on a sunny day in late winter, and many are taken by birds or nipped by the return of night frosts before they can shelter again; but it is different with those that live (and feed, weather permitting) below the surface.

The mild weather keeps both the plant and ground in a condition which suits them, and, though we cannot say that the cold kills them, as the Daddy Longlegs grubs will stand being frozen without hurt, still, for the time being, frost "firms" the surface as effectually as the roller, and with such grubs as go down deep in frost, and do not come up again *directly* it is gone from the surface, the crop gets a little respite.

Last winter (1883–84) it will be seen from the observations that the grubs were advanced enough in growth to sweep off autumn-sown wheat in December, and they continued actively at work through the winter; damage continued to be reported through the season, until in

autumn, specimens of the chrysalids sent in showed that the autumn flight of the Daddy Longlegs Flies was soon coming to set up attack for 1885.

As usual some of the worst attack was on crops after broken-up Grass or Clover; it was also reported from the peaty soil of the Lincolnshire Carrs, and from low-lying land near a river, about three feet above the water-level. The grubs were found in injurious numbers in rotting turf, also sheltered beneath turfs and under clods, which gives a hint where to search for them in hand-picking, besides directly amongst the crop.

Amongst direct remedies noted hand-picking was found serviceable, likewise hoeing, which was noticed to cut through many of the grubs; but rolling did not answer with any certainty. Amongst the applications to help the crop over attack, *nitrate of soda appears to have answered much the best*, and the careful experiments of Mr. Ralph Lowe show that this chemical has an immediately injurious effect on the grub, besides having the good fertilising effect on the crop, which we are aware of. The *non*-effect of other chemicals, and the amount of weight bearable by the grub, shown by Mr. Lowe's experiment, are also serviceable practically.

One of the earliest notes of the season was sent from Westleigh, near Bideford, Devon, on the 8th of February, by Mr. Edward Berry Torr, as follows:—

"I am sending you, by this post, a few grubs collected from a seven-acre field, which they have attacked and destroyed twice. The field was in wheat in 1880, and seeded down with grass; it was fed with sheep and horses in 1881, and the same in 1882; and ploughed 'ley' for wheat on October 9th and 10th, 1883. It was then well harrowed, and sowed with wheat on November 14th. The seed came up nicely, it having been pickled with Down's 'Farmer's Friend' and tar to prevent the birds attacking it. It had not been long above ground before it was noticed as looking sickly, and in a short time it ceased to exist. We then searched, and found these grubs underneath the remaining blades of wheat. Thinking they might not attack a second sowing we harrowed over the field on January 3rd, and left it for a few days for the Rooks to eat up these grubs. They went to the field, but soon left it; and on January 7th and 9th the field was resown with wheat of another sort, but pickled, as before described. I went to the field on the 28th, and could see but few blades of wheat above the surface, and I made but a slight inspection, but found a few grubs.

"On the 4th inst. (February) I again inspected the field, and then found plenty of the enclosed grubs, and also a few grains of wheat partially eaten by them. To-day I have sent my foreman, who,

after much difficulty, has found the wheat sent herewith, but had no trouble to find *hundreds* of the grubs.

"Later on the field was ploughed in the middle of March, and worked down and sown with Barley on April 15th, and was *manured with* 1 *cwt. of nitrate of soda as soon as well above ground, and the result was entirely satisfactory.*"

On the 21st of May Mr. Thomas Read reported, from New Barn Farm, Keynsham, the loss he was sustaining from the destruction of his Barley plants by a grub (Daddy Longlegs from specimens forwarded) which attacked the plant when putting out the second blade, and continued its ravages up to the date of writing, clearing the plant as it traversed the field about half an inch beneath the surface of the soil.

Mr. Read noted that, the soil being very stony, he could not use the harrow, or should destroy the plant. "*An exceptionally heavy roller had been used without the slightest effect on the grub.*"

Shortly after more specimens were forwarded, apparently full grown, with the mention that they did not then appear to be spreading so fast in the field; likewise that, before writing the previous letter, the field had been given *a heavy top dressing of nitrate of soda.*

On the 15th of April Mr. J. B. Scott, of Sutterton, near Spalding, wrote regarding the same pest:—"Since last autumn I have suffered from a plague of black grubs. The first field I noticed was wheat sown October 17th *after grazed seeds* down one year.

"I saw the wheat came up slowly, and appeared to be eaten off by something. I dug in the drills, and found the land to be swarming with little grubs, which have since grown much plumper and longer. I sowed in December two tons of soot in the worst part of the field, but it failed to kill them, though the wheat that is left looks a darker colour for it.

"I have since Cambridge rolled and harrowed it, and sown two tons of salt and half a ton of nitrate of soda on about twelve acres of land, but the grubs still survive, though I believe their ranks are considerably thinned.

"In spite of the wheat improving a little I have had to patch up with April wheat two or three acres of the thinnest places.

"I fancy that *my top dressing will cost me as much as the crop will be worth at present low prices.*

"My wheat after Beans was also partly destroyed by the same grub.

"I have also a field of Oats, sown *after two years grazed seeds*, looking thin in the low places, and I find the grub is the destructive agent. I drilled artificial manure to help it out of the way of the grub.

"This grub has caused me great disappointment and loss, as my corn went in fairly well and was not damaged by wet.

"The soil is, part of it a heavy loam, but silty on the high portions of fields.

"For the future I shall, if I can spare the feed, *plough up Clover leys just before harvest*, and work them about.

"I should think that if the leys could be broken up, say early in August, it might prevent the Daddy Longlegs depositing its eggs, as I did not notice the grass-lands swarming with the flies till the latter end of August and September."

On the 10th of May Mr. Scott wrote further:—"My wheat has improved in colour, but is still thinned by the grubs.

"I have just hand- and horse-hoed it, which has disturbed it, *and cut a many in pieces.* I have a few Spanish fowls near the field, and I notice that they pick up some food after the hoers, and think it may be the grub.

"Some six or eight weeks ago I saw large flocks of Starlings on the field plagued with the grub, but have not noticed any on very recently."

On the 24th of May the Oats, after two years' seeds, were just finished being hand-hoed, and, owing to the land setting hard, and the sods making it hoe badly, it cost 5s. 4d. per acre.

Boys were employed to pick up grubs for two days in the low parts of fields, where they were most abundant, and picked up about eight pints. Some grubs were still to be found, but *since the weather had been dry and cool* the grub was not quite so near the surface.

From the above observations it will be seen the grub was destructive, and necessitating expense to keep it down from December to the end of May; and the result Mr. Scott noted on Oct. 20th as follows:—

"The grub continued to work at my Wheat and Oats till about the beginning of June. I have just thrashed a portion of the grub-worked wheat-field, which has yielded at the rate of 4½ qrs. to the acre, but I had to patch up with April wheat. The crop was the heaviest where I had sown soot at the rate of 5 or 6 cwt. per acre. Owing to the low price of wheat I do not suppose it will pay for the top-dressings and hand labour."

With regard to prevalence of grub-attack in the neighbourhood of Spalding, Mr. Scott reported that a farmer at Kirton, about five miles off, had a fourteen-acre field of Oats, and likewise his Beans, quite destroyed by this pest, and many farmers suffered more or less in that part of Lincolnshire, where the land is heavy.

The following notes refer to attack on the *peaty soil* near Mansfield, Nottinghamshire, and to the presence of "grub" in *wet land;* likewise to grubs being found in *rotten turf;* and to turfs and clods being favourite sheltering places in fields.

On May 15th Mr. Fred. Turner, writing from Mansfield Woodhouse,

Mansfield, forwarded me a box of Daddy Longlegs of the blackest slate-colour I ever saw, with the mention that they were infesting a particular part of the Duke of Portland's property near Gringley, on what is known as the "Carrs." A quantity of the moist peaty earth in which they were found was put up with them, and the colour of the grubs was hardly distinguishable from that of the peat-soil. It was noted that "the havoc just now is very serious, and much anxiety is expressed as to the best means of getting rid of such a very dangerous pest to growing crops, which it devours *not by yards, but by acres.*"

On the 9th of May specimens of Daddy Longlegs grubs were forwarded by the Hon. C. Bouverie, with the mention that they were injuring various plants in the garden at Longford Castle, Salisbury. The ground was noted as made soil, partly on a river deposit, partly on clay, lying very low, water-level three feet below surface. As this kind of grub has a habit of collecting in parties under turfs lying on the surface of the ground, I suggested, amongst other things, placing damp turfs near the infested spots, and examining them from time to time and clearing away the grubs. Later in the year I was informed the plan had been tried, and proved partially successful.

On Sept. 3rd Mr. Bouverie forwarded more specimens of "grub," accompanied by chrysalids of the same, found together under turf in a low-lying situation near the River Avon.

From a communication received through the courtesy of the Editor of the 'Farmer's Gazette,' Dublin, I take a note that under one sod which had been brought to the surface by the harrow and then pressed down by the roller, so as still to retain a little moisture, no less than ninety-four grubs were counted.

On the 1st of May Mr. R. Laycock wrote with respect to "grubs" then attacking his Oats at Winlaton, Blaydon-on-Tyne, and forwarded specimens taken from under *clods of earth.* He observed:—"As anything I may put on the land to kill them seems hopeless, I think of trying to set people to collect them, and thus save part of a crop of Oats"; and later on he reported that the *hand-pickers had killed a large number*, and likewise the Rooks came and had a feast.

The following communication shows how rapidly heaped rotting turf is sometimes infested:—

On the 24th of March I received a packet of Daddy Longlegs grubs of various ages, up to being a third or half-grown, from Mr. J. Watson, Agent's Office, Shirburn, Tetsworth, with the mention that they were doing much harm to valuable plants in a propagating-frame, in which the soil was taken from a heap of old turf. The turf had been taken up about four inches deep at the end of October, and put in a heap. At the end of February some of it was sifted for use in the frame, and

the grubs appeared at the same time in the frame and in the remaining portion of the turf-heap. Hot lime applied in good quantity to some of the grubs, which were caught for experiment, killed them in about two minutes; but lime and soot applied to check attack (in small quantities) had no effect, and the attack was presently checked by *hand-picking in the evening.*

The point of whether the grub is *commonly* to be found on the surface of the ground between dusk and dawn is of considerable importance relatively to best time for rolling; but the observations seem to leave this matter where it was, namely, that the grubs sometimes come up, and sometimes stay below the surface at night.

Mr. Berry Torr favoured me by having special observation taken at Westleigh, near Bideford, when bad attack (as mentioned above) was going forward, and the grubs were found on the surface in large numbers at about 1 o'clock in the middle of the night. This was in February.

On the 10th of May, Mr. Scott wrote me, from Sutterton Grange, Spalding, relatively to search for Daddy Longlegs grubs above ground: —"I have looked for the grub at 8, 9, 10, and 11 p.m., but have not yet seen one above the surface of the ground. I found them an inch or so under the surface, the same depth as in the day."

The following notes give a few observations of the *presence or absence of birds on infested fields*, but it cannot be said that the labours of the Rooks were wholly satisfactory, neither that the operation of clearing off the grubs appears good for the domestic fowls.

The following note, sent on February 22nd by Mr. T. Wreford, from Clannaborough, Bow, N. Devon, refers to a great visit of Rooks accompanying great presence of "grub":—"A field of wheat tilled on the 9th of November was thick and rich-looking up to 2nd December. There were a few days of rather sharp frost about this time: the day the frost left the land I was surprised to find the field so gay-looking turned to a dead brown fallow. We have several rookeries around here, and in a few hours the birds had absolutely almost destroyed every plant in the field.

"My hind took at once the side of the Rooks, and we made a close examination of the soil. We took different parts of the field, and we found sixteen grubs in sixteen square inches. To resow the field is useless, as there is grub enough to destroy twenty crops."

Mr. T. Read, of New Barn Farm, Keynsham, reported, on the 21st of May, that the only birds that visited his grub-infested Barley in any quantity were the common Plover or Lapwing.

On the 7th of May Mr. Smith, of the Grove, Cropwell Butler, near Nottingham, forwarded specimens of the Daddy Longlegs grubs, with

the note :—" I send you specimens of the grub that has been and is destroying us acres of Beans.

" The field where the Beans are was Red Clover and Rye grass last year, and was ploughed up about the end of February. The Beans were drilled three bushels to the acre. We noticed that they were very thin in certain parts of the field, and there is one patch of about two acres with scarcely a Bean left.

" I remember no particular difference in soil or cultivation to account for the attack on this particular spot.

" The Beans have been destroyed in a less degree over most of the field. Some of the grubs are visible on the top of the ground, but if the soil is slightly scratched they are to be seen by the score on the square foot.

" A neighbour has had a fowl-hut taken into his field, and, a fowl dying, he opened it, and found it to contain several hundred grubs.

" I have not noticed any birds such as Rooks on our field. The soil is a fine loam on red clay subsoil."

Experiments as to effects of Chemical applications and pressure on Grub, &c.

On the 1st of June Mr. Ralph Lowe, writing from Sleaford, Lincolnshire, reported that the enormous numbers of Daddy Longlegs observed in 1883 were producing the result to be expected. The larva had for some months made havoc with Wheat and Barley; at the date of writing many fields of Beans were suffering from its ravages; and in gardens the Scarlet Runners and Peas had been injured.

Details of attack are given on a field at Ewerby :—" A sixteen-acre piece of Clover had been manured with farmyard manure, half with manure made in 1882, laid on in March (1883); the field was mowed for fodder, and the eddish eaten with sheep. The other half of the field was then manured with *fresh-made manure*, ploughed once, and drilled with Barley.

Patches came up irregularly, and these patches became larger, and soon were quite bare; and it was found that great quantities of what were called 'Black-worms,' or Leather-skins [*i. e.*, Daddy Longlegs grubs, Ed.] were destroying the plant upon the part manured with the *old manure*.

The worst parts were harrowed, and rolled with heavy rollers repeatedly, getting a good tilth. It was drilled again with Barley, which fared nearly the same as before; the grubs ate the young shoot, and then the grain itself.

" I found great quantities of the larvæ of the Daddy Longlegs, some fully grown, others half that size, under the furrow, where they were quite secure from the effects of the heaviest roller."

From these Mr. Lowe selected a number for the following experiments, with a view of ascertaining whether the various applications were of service beyond stimulating the crop to a more rapid growth.

A few of the grubs were covered respectively with quicklime, soot, household salt, and superphosphate. These were secured, as they crawled away from the applications, for further investigation. Others were placed in earth mixed with one-fourth of white arsenic; and in twelve hours only those which had been in the arsenic appeared at all the worse, and even these recovered before the following day.*

Brine was tried at a strength of one pound of salt to a quart of water, and the grubs dropped *into* it died in a short time; those on which the brine was merely poured were none the worse.

Nitrate of soda, however, gave different results. The grubs that were placed in it were *apparently* dead in three hours.

"Mixing nitrate of soda with a considerable quantity of earth had the same effect; the grubs were *to all appearance* killed pretty quickly, both large and small ones." Likewise, "A weak solution of nitrate of soda poured upon soil containing a large quantity of the grubs, likewise to all appearance killed the whole of them."

Mr. Lowe observes:—"So far I think that where the larva of the Daddy Longlegs are suspected, it would certainly give good results (*for roots*) to mix nitrate of soda with farmyard manure, turning twice.

Later in the year Mr. Lowe went over his experiments again, and verified the point that salt, lime, soot, and superphosphate did not inconvenience them; but with regard to those treated with nitrate of soda, though they appeared to be dead, yet placed in damp soil they recovered, and in a few days were as vigorous as the others.

From this second experiment it is open to doubt whether the grubs which appeared dead after treatment were so or not; but, looking at Mr. Lowe's note that those which recovered did so "after being placed in damp soil," I certainly think that his experiment greatly confirms the value of nitrate of soda as a *direct deterrent* to the grub, as well as stimulant to the crop.

It is shown that the presence of this application, whether mixed with the soil or in solution as a watering, has a direct ill-effect on the grub (which I can confirm from having seen it void its contents when dropped into the nitrate); and here, I think, we may rest on three useful points. The nitrate is beneficial to the plant; it is also hurtful to the grub; and, even if it only makes the soil affected distasteful, we get benefit by driving the creatures partially away.

Further, Mr. Lowe, to try the effect in ordinary circumstances,

* Some of the grubs that had been covered respectively with salt, quicklime, and soot were placed in bottles with partially rotted leaves and sprouted grain, and were developed in due course to flies.

filled pots with earth, and, having placed grubs at a depth of within one inch of the surface, these pots were respectively covered with an amount of salt representing 1 ton per acre, lime 3 tons per acre, and nitrate of soda 2 cwt. per acre. These were watered with rain-water until the soil was well saturated, and "the effect in salt and lime was not perceptible. The grubs treated with the nitrate of soda were very relaxed, soft, and helpless—"will probably die"; and eight days after Mr. Lowe wrote that they still continued limp and helpless.

With regard to amount of weight that could be borne by these grubs, Mr. Lowe placed some of them in a box of moderately damp soil, about an inch from the surface, and applied a pressure of 2½ cwt. for five minutes. The soil was pressed very close, and the grubs, on being *exposed to the air*, soon recovered.

Repeating the experiment for the same length of time—that is, five minutes—with the lesser weight of 2 cwt., but *leaving the grubs in the compressed soil*, it was found that forty-eight hours afterwards none of them had moved, and Mr. Lowe considered they would not have moved, but died where they had been pressed down.

The above experiments appear to me of much value in confirming or showing the method of action of two of the accepted methods of lessening the ravage of Daddy Longlegs grubs.

The following note refers to a case in which the presence of the grubs of one of the mud-feeding kinds of Daddy Longlegs in drinking-water drew attention to the course of the supply-pipes having by mischance been so altered as to convey the water after its passage through a cattle pond instead of direct from the cistern.

On the 28th of February Miss F. A. Gibbings wrote from Cranham, near Stroud, Gloucestershire:—"At present we are much troubled by large grubs in the drinking-water. I find the pipe that supplies us has communication with a pond to which the cattle have access. I enclose a specimen. They are most unpleasant creatures to discover, as we did three days since, in water poured out of the tea-kettle, and I may add *all in the house* have lately been ill."

On examination the grub proved to be the larva of a large kind of *Tipula*, but, what was of more importance, was the state of the water in which it was forwarded being so foul as quite to account for the continued illness of several members of the household.

I therefore telegraphed to the sender to stop any more of the water being used for drinking purposes, and likewise took on myself to report on the subject to the Health Officer of the district.

On investigation it appeared that the water-supply had originally been conveyed by pipes from a tank at same distance, and at some

time unknown a drinking-place had been made for cattle by forming a pool across the course of the pipes, taking up a portion of them, so that the water ran into the pool on one side pure and clean, and replacing them on the other, so that the water-supply went on again from the pool, in whatever state the water might have become there. The pool was noted as full of duckweed and green slime, and was open to defilement by cattle standing in it; and on inspection the Sanitary Officer stated that the water was injurious to the health of those drinking it. A list was sent to me of various water-insects which had floated down the pipe, and which came with the drinking-water on turning the tap. These included Dragon-fly grubs, also grubs of some of the large water-beetles, and other insects besides those I had seen.

The above observation is of service in turning attention to the need of looking, when unaccountable illness occurs, as to what may have happened where supply-pipes are open, even to possibility of being tampered with, and likewise to note that, though Marsh Daddy Longlegs grubs and others may do no harm beyond being exceedingly disgusting when appearing from a tea-kettle, yet that the foul mud that suits them, and the dirty weedy water that suits other larvæ, are sure parents of illness, and the presence of the grubs is a sure sign of *something amiss that should be looked to without loss of time.**

Corn Thrips. *Thrips cerealium*, Haliday; *T. physapus*, Kirby.

The attack of Corn Thrips is one of those which often does a great deal of harm very quietly, and without the cause of the mischief being suspected, on account of the minute size of the insect, which is scarcely more than the sixteenth of an inch long.

Thrips are well known to gardeners as being troublesome in frames, and they are also generally well known as the little black speck-like insects often seen wriggling actively about in flowers; often, too, by

* The larva differed from those of the common crop *Tipulæ* in being decidedly larger, likewise in having a tuberculated caudal proleg; this was formed of two long and pointed tubercles, each placed on a gibbous or tuberculated base. The specimens sent were of various ages, and the only description I find corresponding with them is that of Réaumur, vol. iv., p. 194, in which he says:—"The figure represents an aquatic larva of one of the kinds that produce Tipulide flies. It differs from the ground larvæ of Tipulides in the fact of the sort of horns, the round and fleshy appendages attached to the caudal extremity being longer than those of other Tipulide larvæ." The description is accompanied by a figure fairly representing the long fleshy filaments placed in a bunch beneath the caudal extremity; but I failed to procure specimens of the perfect Daddy Longlegs to which it would in course of time develop.

the annoyance they cause in hot weather by settling on the face, where they twist in all directions, holding on by their bladder-tipped feet, whence they take their German name of "Bladder-foot."

With the help of a magnifying-glass the insect will be seen to be long and narrow, and furnished with three pairs of jointed legs. Throughout their different stages the Thrips are almost exactly alike in shape, excepting that the female has two pairs of long, narrow, fringed wings. The male is wingless.

1—4, THRIPS CEREALIUM; 5—8, T. MINUTISSIMA.

1—4, Corn Thrips (female), nat. size and magnified; 5—8, Potato Thrips, nat. size and magnified.

The colour of the Corn Thrips is deep yellow in the first stage, paler in the second or pupa-state, and black or pitchy when perfect. The above figure shows the female Corn Thrips at rest, and in the act of flying; and the figure of the Potato Thrips is added to show the difference in shape of the wingless condition.

The Corn Thrips lays its eggs on Wheat, Oats, and generally on Corn and Grasses, and the insects may befound as early as June in the ears, and also in the sheathing-leaves of the stem. The injury is caused by the Thrip drawing away the juices by its sucker-like jaw-apparatus, and thus the grain shrivels and becomes abortive.

In the case of Oats, I think the amount of mischief done has not been fully worked out, for in 1883 I received specimens of Oats which were considered to be "blighted," that is, the lower part of the head was undeveloped, though there was no obvious cause. In 1884, however, I received specimens from another locality of the same kind of attack, with which Thrips were certainly present. I therefore incline to think that this failure of the lower portion of the Oat-head is owing to the habit recorded in Curtis's 'Farm Insects,' p. 285, of the Thrips attacking the Corn-stem above the knots, and so sucking away the juices as to injure the development of the ear.

On July 21st Mr. D. Byrd forwarded heads of Oats for examination

from Spurstow Hall, Tarporley, Cheshire, with the observation that he had a field of Oats much injured by a small insect answering to the description of Corn Thrips. Other insects were noted as being present, as Corn Aphis, and a few larvæ also, similar to those of the Sawfly, had been on the blade of the Oat; but with regard to the special attack it was observed that many of the heads were void of grain, this being destroyed by the very small Thrips which were inside the husk.

On examination I found Thrips present, and in November Mr. Byrd reported:—"Our Oat crop, that I named to you some time ago, must have lost fully 25 per cent. by the Thrips."

On the 2nd of August Mr. H. Stourton, of Holme Hall, near York, forwarded injured ears of Wheat as specimens of the method of attack of a small yellow insect about the twentieth of an inch long, which was then doing much damage in the neighbourhood. It was found inside the chaff at the root of the grain, and it was estimated that in some places 10 to 15 per cent. of the grains had been eaten.

On examination the Wheat proved to be much infested by Thrips, and the above description just conveys the method of attack on Wheat. The Thrip fixes itself by its sucker or jaws to the tender corn near the bottom of the grain, and thus, by drawing away the juice, causes the partial shrivelling or entire loss of the grain.

On Sept. 10th specimens of two kinds of Wheat were sent by Mr. F. W. Earle, from Huyton, near Liverpool, as specimens of an injury taking place on neighbouring land, which caused loss or abortion of the grain. This damage was also obviously in connection with Thrips.

It appears quite impossible to do anything to check Thrip-attack when once established in the Wheat-ears, by reason of the minuteness of the insects, but a good deal may be done in the way of prevention.

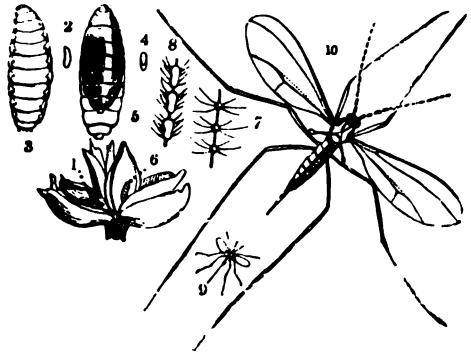
"The circumstance that Thrips are to be found in autumn (and still later) in large numbers in rotten roots, or in *stubble*, and in similar lurking-places, and also in the next spring before the development of the insect from the egg can have taken place, speaks for the hybernation of the Thrips in its perfect state, and also for its subsequent attack."* The perfect insects are thus preserved, and next spring, the females being furnished with wings, have full power to fly, or to be carried by any light breezes from their wintering places, to neighbouring corn or grass, where they will start new attack. Therefore, any measures for destroying their lurking-places would be sure to be of service; and the treatment used to prevent attack of "Red Maggot" in Wheat would be equally serviceable against Thrips.

* 'Insekten kunde,' by Dr. E. L. Taschenberg, pt. iv., p. 214.

Deep ploughing, so as to bury the Thrips well down, or dressings of salt, or anything to poison the surface of the land, would be useful where the corn was known to have been badly infested.

Removal of waste pieces or headlands of wild grass would also be desirable, as these serve as propagating grounds, as well as winter shelters, from which the Thrips come out on the corn.

Wheat Midge. *Cecidomyia* (*? tritici*), Kirby.



CECIDOMYIA TRITICI.

1—6, larvæ, nat. size and magnified; 7 and 8, part of horns, magnified; 9 and 10, Wheat Midge, nat. size and mag.; infested floret.

The following observations refer to the loss caused by presence of Red Maggot in seed of Meadow Foxtail Grass, both imported and home-saved; but they bear also on the point of maggot-attack being conveyed in seeds, and also on the Red Maggot of the Wheat, or other kinds so nearly allied as to be indistinguishable from it, being found to a large amount in grass.

On the 7th of January I received a communication from Mr. James Hunter, Chester, requesting the name of larvæ enclosed taken from seed-heads of *Alopecurus pratensis* (Meadow Foxtail Grass). These proved to be maggots of a *Cecidomyia*, and very nearly, but not quite, similar to the well-known Red Maggot of the common Wheat Midge, *Cecidomyia tritici;* and from further examination during the season it appeared that the Foxtail Grass was subject to attacks of one or more kinds of these Wheat or Grass Midge maggots.

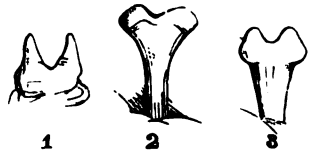
Mr. Hunter mentioned with regard to seed sent from Germany, Russia, &c., that the seed of the Meadow Foxtail harvested in 1882 contained about 25 per cent. infested by larvæ, and of course the germination of the seed was injuriously affected to that extent. The seeds of 1883, however, were only affected to the extent of 5 per cent.

Later in the season, on the 3rd of July, Mr. Hunter forwarded heads of the same kind of grass collected in the neighbourhood of Chester, of which he wrote as follows:—"Looking at this subject from a commercial point of view, if the flower-heads of *Alopecurus pratensis* grown in different parts of England are as badly infested with larvæ as those grown in this neighbourhood, both this year (1884) and last year, then it would seem that agriculturists cannot hope to save this seed for themselves in this country, and that we must continue to depend on the continental supply, which fortunately is so much less affected.

"The percentage of seeds of *Alopecurus* infested by larvæ which I have examined since last harvest (of continental growth) would average about 5 per cent., perhaps less, but were seeds saved from the heads forwarded [to myself, Ed.] last week, I believe 75 per cent. would be found non-germinating from the presence of these larvæ."

The heads sent were badly infested; many of the orange-red maggots were still to be found at the base and within the florets, in which case I did not find forming seed; and it is important to notice that, after the box containing them had been placed for a day or two in a damp situation, some of the maggots were crawling out of the heads, a point to be referred to presently amongst considerations of prevention.

The maggots sent successively accompanying the above observations were all of some kind of *Cecidomyia*, but they varied slightly among themselves in depth of colour (which may not be an important difference), but also in the shape of what is called the "anchor organ," the forked process lying beneath the maggot pointing forward from the third ring from the head, and also in this process being sometimes



2, Anchor process of Wheat Midge maggot; 1 and 3, of Foxtail Grass maggot.

absent. The form of this process, or "anchor organ," as it is sometimes called, is one of the points of distinction between *Cecidomyia* maggots, and in the Red Maggot of the Wheat it is somewhat lunate, as shown at fig. 2.*

* Fig. 2 is given by permission from a much magnified sketch of the anchor process of the larva of *Cecidomyia tritici* taken by Prof. Allen Harker, of the Royal Agricultural College, Cirencester, who is pursuing the subject of investigation of the form of this process in other *Cecidomyiæ*, which may prove of much service in identifying the species. The skin of fig. 1 was somewhat shrivelled.

Some of the specimens of the *Alopecurus* grubs were furnished with a lunate process, which appears to me similar in characteristic shape as shown at fig. 3; some with a more pointed form figured at 1; and in some the process was wanting.

From this I infer that the Red Maggots were of various kinds, *some* of them the larvæ of *C. tritici*, but they were apparently alike in their habits; and this view was confirmed by observation of insects in their complete state—the Wheat or Grass Midges of the Meadow Foxtail Grasses—forwarded later in the season by Mr. Edmund Baillie, also from the neighbourhood of Chester.

Mr. Edmund Baillie's communications on the subject of the *Alopecurus* Red Maggot began on May 8th, when he mentioned that in the course of an examination of a sample of seed of the Foxtail Grass a few years previously he found many of these seeds contained this small yellow maggot, which was, after microscopic examination, identified as the larva of a *Cecidomyia*, and considered to be that of *C. tritici*,—that is to say, was considered to be the common Red Maggot of the Wheat Midge.

Pursuing the subject as to date and amount of the appearance of the midges on the Foxtail flowers, Mr. Baillie wrote, on June 10th:—"I had an hour with the Foxtail Grasses this evening, and send some of the midges. On this evening they were noticeable in great numbers; 'I could have got hundreds.'"

On June 25th Mr. Baillie spent from six to eight in the evening in the meadow:—"I lay down amongst the grasses and carefully examined the lower lying foliage leaves, gently disturbing the stalks about me. I then found a number of the midges amongst the grasses,—tried for two hours to catch them, but could not get one!"

At 10·30 p.m. Mr. Baillie secured a few specimens. The following morning (June 26th), at 5 a.m., he only secured two, but again in the evening they were plentiful. "This evening I renewed my search, and was successful in finding them in abundance. I watched their habits closely for a time. I find they *rise from the lower leaves, fly about until they rest either upon the head or upon the stalk of an inviting grass; invariably, so far as I see* Alopecurus. One alighted upon the stalk, ran rapidly up it until it reached the head, and there remained contentedly."

This account of the habits precisely agrees with that given by Mr. Kirby ('Transactions of the Linnean Society,' vol. v.) of the habits of the Wheat Midge, in which he mentions that the midges "were seldom to be seen much before seven o'clock, *at eight the field appeared to swarm with them;* but, though so numerous in the evening, not one was to be found on the wing in the morning." They do not, however, then quit the field which is the scene of their employment, for upon

shaking the stalks of the Wheat, or otherwise disturbing them, they will fly about near the ground in great numbers. "I found their station of repose to be upon the lower part of the culm, with their heads upwards."

I give Curtis's figure of the "Wheat Midge," here alluded to, at the head of this paper for convenience of reference. The specimens forwarded to me by Mr. Baillie almost exactly resembled this kind, the *C. tritici*, but I could not take upon myself to say whether they *were precisely the same species* or not. I therefore forwarded them for the benefit of thoroughly skilled examination to Mr. R. H. Meade, of Manningham, Bradford, who stated the insect belonged to the *Cecidomyia*, subgenus *Diplosis*, H. L. W., and he considered it was probably a new or undescribed species. The specimens sent might possibly be small varieties of *C. tritici*, but as all that were sent were females the kind could not be determined with certainty.

On the 18th of July attack from the midges mentioned above was set up in the heads of the Foxtail Grass, and Mr. Baillie reported :—"I find the larva of *Cecidomyia* present, now so far advanced as to admit of proper examination. I yesterday took one head and analysed the seeds, dissecting them and examining them with sufficient care to enable me to say that the result here given is about correct. I found the head composed of 'seeds' as follows :—187 apparently empty and unopened glumes; 179 'filled' seeds of good quality; 75 containing larvæ."

The maggots, of which specimens were sent, proved to be of the Red Maggot with the somewhat pointed anchor process.

We have thus the complete season's observation : maggots found in the dry seed which had been harvested ; the midge at work laying eggs in June; and the beginning of the attack of maggots in July ; and I have given Mr. Baillie's careful observations in detail, as thus we have proof of the habits of this midge, and the Wheat Midge, being so similar that it may be presumed all methods applicable for prevention of the Wheat Midge are applicable to the Foxtail attack.

These turn mainly, as has been mentioned in previous reports, on such treatment of stubble as will destroy the maggot sheltering at the corn or grass roots; as, for instance, collecting stubble-roots in heaps and burning them; likewise deep ploughing, which will bury the maggots; and likewise so treating infested chaff as to destroy all maggots in it. Further, the *removal of wild grasses*, which may be food-plants for the maggots, from round corn-fields; which treatment is proved to be eminently desirable by the present observations of the extent to which "Foxtail" is infested.

This matter of the Red Maggot has to be looked to in the double light of both a corn and grass seed pest, and where Meadow

Foxtail is grown for seed, extra care will be needed as to Wheat grown near.

As yet it has been considered impossible to apply any remedy in the growing corn for Wheat Midge attack, but the observations given above of the midges *lying quietly during the day amongst the lowest leafage* of the attacked corn or grass seems to point to the possibility of some good being done by throwing dressings. So far as growing *Alopecurus* in patches for seed is concerned, the plan might be tried of throwing applications of the same kind as those used for Turnip Fly. A mixture of one bushel of fresh gas-lime, six pounds of sulphur, and ten pounds of soot, thoroughly mixed and powdered as finely as possible, was enough, in Mr. Fisher Hobbs' practice, to dust two acres of Turnips. If this or any other similar mixture with sulphur in it was applied when the dew was on in the morning, so as to adhere to the lower leaves whilst the midges were resting amongst them, it is very likely many would be killed, and also the leafage made thoroughly obnoxious as a shelter. Should the experiment be tried notes of the result would be very acceptable for publication.

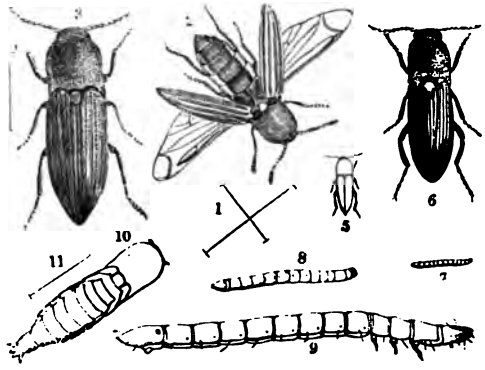
With regard to the special point of clearing the maggots from "Foxtail" seed, Mr. Hunter informs me that, "if *Alopecurus* seed is highly winnowed, most of the larvæ-infested seeds are separated from the good seed (although some good seeds are also taken out in the process), the reason being that a larva is not as heavy as a well-developed seed, and so it is driven out."

The enquiry has been made whether the use of seed of which a considerable proportion was infested by these larvæ would have any injurious effect on young pastures, it being borne in mind that the pastures are merely for grazing, and *not for the production of seed?* Where this is strictly the case no damage would arise to the pasture from the use of infested seed beyond the loss of the amount of seed killed by the maggot, because, as far as we know, the "Red Maggot" only feeds on the seeds or in the blossom; but in the broad question sent in from another quarter as to whether *sowing infested seed produces an infested seed crop*, the answer is not so certain.

From experiments tried there seems some reason to think that sowing the seed with the maggot amongst it is followed by attack, and from the winter state of the maggot this seems likely enough.

Of the maggots sent me in *Alopecurus* seed in the winter, some appeared dead, but I am far from being convinced that they *all* were past recovery; and if so, putting them in the ground with the seed would be putting them in just the right place for development, and for the midges in due time to come out from, and infest either the crop with which they were sown, or neighbouring Wheat.

Click Beetles and Wireworms. *Elater* (*Agriotes*) *lineatus* (and other species).



ELATER LINEATUS, &c.

1 and 2, *E. lineatus*; 3 and 4, *E. obscurus*; 5 and 6, *E. sputator*, nat. size and mag.; 7, larva of *E. sputator ?*; 8 and 9, larvæ of *E. lineatus*, nat. size and mag.; 10, pupa. Lines show natural size.

The following carefully-detailed note, sent by Mr. James Davies, Bollington, near Altrincham, Cheshire, draws attention to operations sometimes completely failing to clear the ground of Wireworm (or other insect vermin), because they are at that time gone down too deep in the earth for measures of cultivation to reach them. Mr. Davies wrote as follows :—

"Three years ago [that is, at Christmas, 1880,] I had a field of grass-land which I intended to plough for Oats. The frost was very severe. When the frost left we had a good deal of rain (so much as to prevent ploughing on *broken* land), so I began ploughing this grass-field *as soon as the frost was out*, ploughing in different parts of the field, setting ridges, and ploughing round each.*

"By the time we had done this much the broken land had dried, and we went to plough it, reserving *the rest of the grass* for another wet time. We finished the grass in the beginning of March, and in due time the field was sown with Oats.

"Then there was to be seen this difference. On the land *first ploughed the Wireworm took nearly every Oat*, and we had to sow it again. On the land *ploughed later there was hardly any damage.*

"I accounted for the fact in this way—probably the severe frost caused the worms to go down into the earth before it to a depth from *which they had not risen when the first ploughing was made*, and (probably

* A plan accompanying showed the grass field divided into seven strips, of which the three ploughed just after the frost lay alternately between the four ploughed later on.

also) they *had risen to furrow-depth when the second lot of ploughing* was done, and so (on this part) they were exposed as prey to birds."

The above observations of Mr. Davies are quite in accordance with the habits of the Wireworms. They go down deeper and deeper into the ground in winter as the frost becomes more severe, and consequently the ploughing, &c., which would throw them to the top in mild weather, is of no service in getting rid of them if applied before they are come up again to their regular feeding level.

The three following notes turn chiefly on the importance of *healthy growth* in carrying the plant through attack, with some observations *as to effect of rolling*.

Mr. T. Aitken, writing from Spalding, observes :—" I am sure that I should have the evidence of most farmers that generally the greatest damage has been done more upon lands wanting in fertility than those receiving frequent applications of well-made farm manure that is produced from highly-fed stock. Indeed, the best remedy I know is land in a good state of cultivation so that the plants are vigorous, and even when cut by the Wireworm, capable of taking a fresh start. This fresh start is often assisted or made possible by the using a heavy roll, or by trampling, saving many a *damaged* plant from destruction by late spring frosts, which, coming when the land was open, destroyed all the weak plants.

"I note that many of your correspondents strongly recommend the making of the land as firm as it is possible, of which treatment I fully approve, as it makes the light land more suitable for the Wheat crop, not that it will stop the working of the insect. [The pressure will not entirely check the movements of the Wireworm, but still any difficulty thrown in the way of travelling will be useful in lessening direct amount of injury, besides the benefit to the plant from the soil being firmed round it.—Ed.]

"The ploughing seed land with a light shallow furrow is also a good system, the Wheat roots growing better if there is a firm subsoil within reach.

"We sometimes have a considerable loss of grain at harvest-time arising from shake ; this produces a quantity of Wheat plants in the following crop of Clover, and I never noticed any damage done to these plants by Wireworm. If this should be the experience of others it would be interesting to have the reasons why."

On the 5th of May, Mr. A. Bannester, writing from Barling, Essex, observed :—" With regard to Wireworms, they are, in this neighbourhood, more than usually troublesome. I have lately saved a crop of Barley (fourteen acres) by the early use of a very heavy stone roller. The Barley in question is now most luxuriant (lately dwindly and yellow), and the roots of the crop prior to the application of the

roll literally swarmed with Wireworms. The previous crop was Potatoes."

Mr. P. Loney, writing from Marchmont, Berwickshire, on the 19th of June, mentioned that there were several patches of Wireworm in the county, but not to any great extent, and good had been done by the application of *top-dressing to Oats and other crops*, thereby giving a more vigorous growth and pushing the plant on as much as possible beyond the destructive effects of Wireworm or grub, as the case might be."

The following observations by Mr. Sturdy, of Trigon, Wareham, give the results of experiments he kindly undertook, at my request, to ascertain the effects of Indian rape-cake on Wireworms.

This point is of very practical interest. I experimented myself in 1882 as to the effect on Wireworms both of the common rape-cake and also of the so-called Indian or Kurrachee rape-cake (which is, in fact, mustard-cake) with the result of the Wireworms being *in no way the worse for being fed on the common rape-cake*, even in the case of this moistened with water being their sole food.

With regard to the Indian cake—that is, mustard-cake—there appeared reason to think it might be poisonous to them: we are all well aware of the good effect of mustard as a clearing crop for Wireworms, and in experiments in which Wireworms were solely fed on this mustard-cake they appeared to be partially or wholly poisoned by it. Therefore, at my request, in order that we might make out what would happen in fairly natural circumstances, Mr. Sturdy carried on the experiments with Indian rape-cake applied as manure to Oats sown in boxes, so that we might be sure of all points noted, but at the same time the Wireworms could choose their own food.

The experiment extended over rather more than a year—from March, in 1883, to May, 1884—and the result, as given in detail below, shows that the Oats manured with the Indian rape-cake, or mustard-cake, throve much better than those that had none; that the Oats so manured were *little attacked compared to the others* not manured; further, as time went on, the Wireworms in the box where there had been no rape-cake duly went through their changes to Click Beetles; but on May 1st—that is, fourteen months after the commencement of the experiment—the Wireworms in the Indian rape, which are noted as having had "no food for many months but this rape-cake," still continued Wireworms, and fat and well.

I repeat the first part of Mr. Sturdy's observations, begun in 1883, to make the record complete:—

"Two boxes were sown with Oats in March, and when about two inches high one box was well larded with bits of the Kurrachee Indian rape-cake you sent me: the bits were about the size of hazel nuts.

Twenty Wireworms were then put into the Oats with the rape-cake and twenty in the Oats without, and so they were left. The *Oats with the rape-cake flourished exceedingly* compared with those that had none, and the former (the rape-cake Oats) were scarcely touched by the Wireworms, while the latter were a good deal injured. This day (May 1st, 1883) I turned out the rape-box, hoping to find all the Wireworms *non est*, but instead I found everyone looking fat and well."—'Report on Injurious Insects,' 1883, p. 39.

On January 31st of this year (1884), Mr. Sturdy further reported: —"On looking at the boxes I found that the lot that had Oats to feed on became ordinary Click Beetles, but that those that had E. Indian rape-cake *only* were still large and well-to-do-looking Wireworms, and so they still remain to this day" (Jan. 31st).

"The result of the experiment is that the rape-cake, instead of being poison to the Wireworms, evidently prolongs their destructive lifetime. How long they will continue to live and flourish in the rape-cake you sent me and water I can at present form no opinion."

On May 1st Mr. Sturdy forwarded the completion of his experiment, which is conclusive as to this diet not being necessarily fatal:— "I have now had the remainder of the Wireworms turned out of their box. They *look fat and well* after feeding on nothing but the rape-cake you sent me for many months."

I do not think we can be absolutely sure that the Wireworm-stage is prolonged by the diet of the Indian rape without further experiment, although it certainly appears to be the case. The Wireworm being very long-lived, it *may* have occurred that those in the Indian rape were somewhat younger; but the clear evidence from parallel experiments of the Oats manured with the Indian rape being the heartiest in growth, and likewise being much less injured by the Wireworms, is a very good piece of observation of practical service.

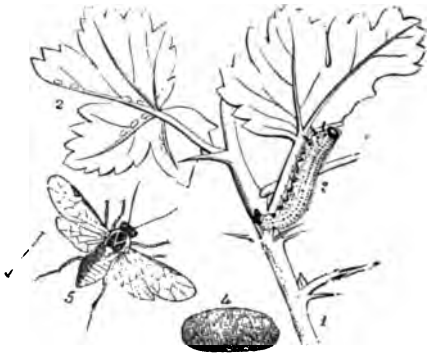
GOOSEBERRY.

Gooseberry and Currant Sawfly. *Nematus Ribesii*, Curtis.

Mr. W. J. Goodwin, of Winfield House, Crouch, Sevenoaks, notes that he considers "the best remedy for Gooseberry caterpillars is to give a liberal sprinkling of fresh good soot early in the morning when the trees are damp, two or three large handfuls to a good-sized tree, so as to make it *quite black with soot*. It is of no use unless it is done when the trees are *damp, so that it sticks on well*. If it comes off by rain coming shortly after, it must be done again. It acts, of course, as

a first-rate manure afterwards, causing the trees to make good wood for another year.

"The caterpillars always first appear on leaves in the middle and bottom of the trees, and may be detected first by a few small holes in a few of the leaves, resembling prick-holes of a pin. This is the best time to apply the soot."



NEMATUS RIBESII.

Sawfly-caterpillar; cocoon, mag.; Sawfly, mag.; line showing nat. length.

Mr. Kay, Barone Cottage, Rothsay, N.B., mentions:—"The caterpillar made considerable havoc not only amongst the Gooseberries, but amongst the Currant bushes, a thing that had not been seen before. I may state that I did not give the ground the usual *coating of paraffin in the spring*, and probably the grubs may have made headway on that account."

The attack of Sawfly-caterpillars on Gooseberry leafage is one which appears certain to appear more or less every year, and often, and especially in bush-fruit growing districts, causes great loss to the growers. As it has now been reported yearly since 1878 inclusive, with various methods of prevention and remedy found to answer for keeping it in check, it may be of use to give a list of the most service- of these under special heading.*

Handpicking the Caterpillars, or shaking them down and destroying them.

"Handpicking, *if taken in time*, the best remedy."—ALEX FORBES.

"Handpicking found to be the most satisfactory remedy."—C. GRIERSON.

. . . . . "On attack being observed put on hands at once, and

* It will be observed from the names appended that the information with which I was favoured was almost entirely contributed by well-known Scotch or English horticulturists, or by large growers in the bush-fruit district in the South of England, of which the addresses are given in full in the respective Reports.

cleared the garden; and thus, although very numerous, the insect was checked."—D. S. Scott.

"Had the caterpillars shaken from the bushes and crushed."—J. Sutherland.

. . . . "Prevented serious injury by shaking down the caterpillars whilst quite small and crushing them on the ground, and by hand-picking later on."—T. H. Hart.

"Trees found to be attacked were immediately well syringed and shaken, the caterpillars dropping on to the soil, where they were treated and burned with hot lime."—W. Ward.

"The most serviceable, and, in the end, cheapest remedy, is considered to be to lay a piece of canvas sufficiently large to cover the surface of the ground under the trees attacked, and give the trees a good shake, thus dislodging the caterpillars, then have the canvas removed and the caterpillars destroyed."—A. Smith.

. . . . . "Crop was only saved by handpicking, and shaking the caterpillars on to sheets placed under the bushes."—Rev. F. Adams.

Dusting infested bushes.

The application which appears most surely serviceable is dusting the caterpillars with powdered hellebore, but, without great care and washing of the fruit, this poisonous dressing is likely to prove so injurious to those who partake of the fruit afterwards that I cannot take on myself to advise the application. With regard to sulphur and soot, the advice given above by Mr. Goodwin at p. 39, and below by Mr. McCorquodale, as to applying them when the bushes are damp, so that the powder should adhere, should be particularly observed.

"Flour of sulphur dusted on the leaves *when the dew is on*, or, if in dry weather, after watering; only necessary to dust the lower part of the bushes if taken in time."—W. McCorquodale.

. . . . . "Used sulphur powder, as recommended above, and found it as useful as hellebore powder, without fear of possible evil consequences."—J. W. Whitton.

"Trees were dusted with hot lime and soot, and there was no further trouble with the caterpillars."—W. Ward.

"A few handfuls of roached lime thrown over the infested plants stopped the evil."—T. Brunton.

Paraffin as watering in spring and washes to the infested bushes. (For method of mixing paraffin washes, see "Paraffin," "Wash," and "Emulsion" in Index).

"Gooseberry Sawfly-caterpillar only appeared slightly. A watering of paraffin had been given early in the spring to the stems of the bushes and the ground beneath them."—J. Kay.

"Paraffin, in the proportion of four ounces to a gallon of water,

was decidedly serviceable, but could not be used after the fruit was ripe."—T. H. HART.

Autumn or Winter removal of surface-soil from under the bushes.

For prevention of all attack, excepting what may be borne on the wing by stray Sawflies blown from elsewhere, I believe the above plan to be the most certain.

The caterpillars go down in autumn a little below the surface, the depth varying from about two inches to somewhat more, according to nature of ground. There they lie in small brown cocoons, like little pellets of earth, during the winter; and when the leafage comes out in the spring, so do the Sawflies from their cocoons under the bushes, and lay their eggs to start attack on the leaves. If the earth is removed, with the cocoons in it, and got rid of in any way the amount of attack is enormously lessened.

"For twenty years Gooseberry Sawfly-caterpillars have not occurred in the gardens under treatment, in any quantity. The surface-soil under the bushes is annually removed in winter, a deep hole is dug in one of the quarters, and in this the removed soil, *with whatever may be in it*, is buried. The soil under the Gooseberry bushes is replaced by that out of the hole, with the addition of some manure."—ALEX. ANDERSON.

"When there is reason to fear an attack [*i. e.*, when there has been bad attack the previous year, ED.] the soil should be removed to the depth of two inches round the bushes in the early spring, and a good sprinkling of lime dusted round each bush; by this means the caterpillars are cleared away and destroyed."—GEORGE MCKINLAY.

"Caterpillars not nearly so injurious as last season. During the winter I removed all the surface-soil from under the bushes."—JOHN MATHESON.

"Gooseberry bushes in my garden, from beneath which the earth had been scraped a few inches deep in the previous autumn and replaced by manure, &c., were free from attack."—ED.

I have also a note from a gardener in this district near Isleworth, where Gooseberries are largely grown, that one method of treatment is to scrape all the surface from beneath them in the autumn and to form it into a line between the rows of Gooseberry bushes, and there *dig it in*.

In this way a great amount of attack is prevented, but it is necessary to be careful as to having the scraped-off surface-soil *dug in thoroughly*. On one occasion I saw the first part of the operation carried out on a large scale,—the earth was scraped from under the bushes and formed into lines between them,—but there work stopped; consequently the cocoons lay just as safely as if nothing had been

done, and when spring came the Gooseberry leaves were again riddled by the caterpillars.

Dressings of Gas-lime and Lime.

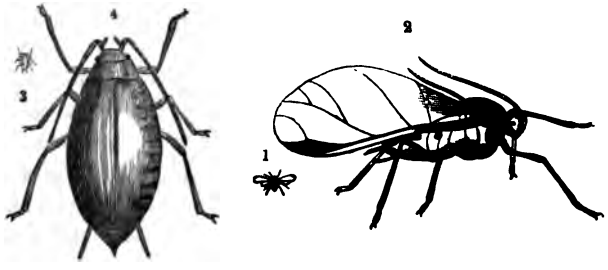
"I dress over all my Gooseberry-ground with gas-lime in early spring before forking over the soil, and have not seen one of these caterpillars for three years."—T. Boyd.

"I am now satisfied that I have benefited by the application of gas-lime between my bushes. Grubs there certainly have been, but, whilst they have almost stripped other bushes of their leaves, those on the dressed ground are little the worse for the attack." — T. H. Hart.

"Currants and Gooseberries in the open garden have kept free from attack. I think this was owing to the trees being dressed with lime early in the spring. Currant trees on the wall *not* dressed with lime were attacked."—A. Ward.

HOP.

Hop Aphis, and Damson-Hop Aphis. *Aphis* (*Phorodon*) *Humuli*, Schrank; and *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb*, Fonsc.



Aphis (Phorodon) Humuli.
Winged and wingless Hop Aphis; nat. size and mag.

During the past season I have been in receipt of specimens and observations relative to Hop Aphis attack from the latter part of March to about the end of August, and, though I should be far from expressing positive certainty on a subject like this which has been one of doubt and difficulty for at least a hundred years, yet, after careful study and also comparison with the published views of entomologists who have attended to this special attack in England, Germany, and the United States of America, it appears to me that there is good reason for believing the course of attack to be as follows:—

1st. That the first attack of Aphis to the Hop begins in spring

from *wingless females* (*depositing living young*), *which come up from the Hop-hills.*

2nd. That the great attack, which usually occurs in the form of "Fly" about the end of May, *comes on the wing from Damson and Sloe, as well as from Hop, and that the Hop Aphis and the Damson-Hop Aphis are very slight varieties of one species, and so similar in habits as regards injury to Hop that for all practical purposes they may be considered one.**

Further, it has been shown by the result of various experiments on the Hop-ground at Stoke Edith Park, Hereford (allowed us by the kind courtesy of the Lady Emily Foley) that the use of various applications round the hills in the late autumn, or about the beginning of April in spring, *completely prevented attack to the bines of* those hills until the summer attack came on the wing.

Amongst these applications paraffin was especially noticeable, as the plants treated with it were reported throughout as thriving up to the point of bearing well; and the serviceableness of mineral oil, both as a preventive and remedy, has been confirmed by the reports of experiments, regarding the use of petroleum and kerosine in dilute state, published by direction of the Department of Agriculture of the United States of America, and of which I give notes under the head of "Kerosine Emulsion."

The following are details of the main points of the information contributed or acquired from various sources regarding Hop Aphis and its prevention during the past season.

With regard to first appearance of Aphides on the Hop, Mr. C. Whitehead, writing from Barming, near Maidstone, on the 29th of March, mentioned:—"I have found the enclosed Hop-shoot, with the larvæ *in situ*, in my Hop-ground this morning. There was a wingless female, which had evidently deposited viviparously the larvæ enclosed." Regarding the state of shoot at the time Mr. Whitehead wrote as follows:—"There is in most places no shoot visible, as most grounds are dressed, that is, all old shoots and early shoots cut off. I dress late, and so I have plenty of shoots which will be cut off soon, and upon these I found the lice I sent to you.

"I went out in the afternoon, and *found lice upon many hills*, to the great amazement of the men. They say they never saw such a thing so early.

"Where there were small lice, in most cases a wingless viviparous large active female was not far off.

"I found them chiefly in a part sheltered from cold winds, and

* By Hop and Damson-Hop Aphis I mean the *Aphis* (*Phorodon*) *Humuli*, Schrank, and the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb*, Fousc.; but in no case the *Aphis Pruni*, Réaum., or any other kind.

where hatching or awakening from hybernation would be early. I should say I found a hundred at least in ten minutes."

On the 31st of March Mr. E. Goodwin wrote, from Canon Court, Wateringbury, Kent, that nearly all the Hops had been dressed; but he had carefully searched in the young shoots, and found some lice in Grape Hops, but could find no signs of any in Golding Hops.

Continuing the observations in order of date, early in April, I heard from Mr. Whitehead that he had found more lice on Hop-shoots; that two farmers had just called and brought more; and on the 10th of April he mentioned that attack had been fonnd on the Hop-shoots in several places in East Kent.

On the 12th of April Dr. T. A. Chapman, writing from Hereford, reported that after careful search in the Hop-yards, where the bine was two feet high, he could find *no trace of "Fly,"* but on the following day he found a bine with seven or eight Aphides on it. These were wingless and nearly full-grown.

In these observations we have clear instance of the wingless females, and the lice being present at the hills in the early sping, long before any appearance of the "Fly" (or Aphis in the winged state), in which it might have been borne on the wind from elsewhere.

This point is strongly confirmed practically by the experiments in the Hop-grounds at Stoke Edith Park, near Hereford. Here it was found that bines from the hills which had been treated (in autumn after the bines were cut, or in spring before or when they were shooting) with various applications suitable to *prevent Aphis effecting a lodgment or coming up through the soil* were perfectly clean (though the rest of the Hop-yard was infested) up to about the end of May, when attack of *winged Fly* began.

Some of these plants had been watered with paraffin and water, and with salt and water in the autumn after the bine was cut, and altogether upwards of 1200 plants were experimented on by Mr. A. Ward with applications of paraffin variously mixed with ashes, sawdust, sawdust and ashes, and also with shoddy; likewise with lime, salt, salt and lime, salt and ashes, soot, gas-lime, and gas-lime and soot.*

A plant also, which had been carefully enclosed under muslin, and of which the ground round the hill had been well watered with paraffin and water, remained free from attack; whereas the one similarly secured last year under muslin, of which the hill had *not* been cleared of attack by dressings, was then smothered with Aphides coming up from the hill.

To recapitulate: we have thus (with regard to the beginning of the attack of the year) evidence of the wingless females being seen

* Details of amount of application and effect on the plant given further on.

depositing lice in many places; we have likewise notes of their total absence on upwards of 1200 plants, of which the hills had been dressed with applications to prevent attack, and the confirmatory experiments where the plant was enclosed under muslin; of attack being *set up* where nothing preventive had been done to the ground round the stock before enclosure; and on the other hand the plant remaining *perfectly clean* where preventive applications had been applied.

After being fairly set up as lice, the attack, as a matter of course, progressed to the full-grown stages; and the following note by Miss Golding, from Plaxtol, Sevenoaks, is, in fact, a history of its regular method of increase. Writing on the 12th of May, Miss Golding mentions that before the colder weather in April she noticed large green wingless Aphides, or a large one and smaller ones together, on Hop leaves, and at (the above mentioned) date of writing she found under the small red sheath at the base of the leaf-stalk numerous Aphides. These were yellowish for the most part; some Fly with green bodies, and also some with "fin-shaped markings on the sides,"—that is, with the embryo wings showing the stage just before the Fly gains its wings.

I also found Fly appearing in a Hop-ground at Sharsted Court, near Sittingbourne, on the 23rd of May.

On the 26th of May specimens of Fly were sent me by Mr. C. E. Edwards, of Marsh Court, Hereford, from bine in a ground about twelve miles distant from thence; and on the 3rd of June he reported Fly as well as lice as being plentiful in another Hop-garden near Hereford.

The above details give the history of the Hop Aphis, *Aphis* (*Phorodon*) *Humuli*, Schrank, distinct from any other, from its coming up from the hills to its early summer commencement of Fly-state. Now I will similarly trace the history of the Damson-Hop Aphis, the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb* (Fonscolombe), from its appearance at the same time as the Hop Aphis in spring to its change to the Fly stage at the end of May, and then point out the reasons (or what appear to me to be such) for considering these Aphides to be very slight varieties of the same species.

The first appearance of the Damson-Hop Aphis, i. e., *Aphis Humuli*, var. *Malaheb*, on Damsons was a little before March 25th; on that day Mr. E. Goodwin, of Canon Court, Wateringbury, Kent, wrote in continuation of previous observations (to Mr. C. Whitehead): —"I am forwarding you some more of those Aphides. A number of young ones have appeared, which you will see swarming round the old ones on the Damson buds I have sent you. The old Aphides appear to be decreasing rapidly."

These larvæ, or lice, I found agreed precisely with the lice from Hop bines.*

On the 12th of May I received information from Mr. W. Gardner, of Bekesbourne, near Canterbury, of the appearance of these Aphides on Plum, and specimens of wingless females and lice forwarded by him three days later corresponded in characteristics with the true Hop Aphis.†

A week later—that is, on the 22nd of May—Mr. Gardner reported that since observing the Aphides on Plum he had carefully examined his Hop-ground close by, but there was no appearance of Fly on the plants until that morning; and still there were no lice, excepting such a small number that he forwarded them in a quill.

On May 29th Mr. R. Cooke, writing from Detling, Kent, showed the gradual march onward of attack by mentioning the "increase of vermin: washings of Damsons and Plums had been going on a fortnight, and Hop washing had certainly been commenced [on the day of writing] in one ground in Farleigh parish. The grounds at Detling were still fairly clean."

The disappearance of the Damson-Hop Aphides from Damson and Sloe was reported on the 26th of June from Wateringbury, near Maidstone, by Mr. R. H. Fremlin, as follows:—"I now send you Aphides from the Sloe, but I cannot find any on the Damsons; they appear all gone, and very few left on Sloe, and correspondingly diminished numbers come to the Hops."

The specimens forwarded had tubercles on the forehead, swollen or slightly gibbous base to the lowest joint of the horns, and long honey-tubes—in short, were either the common Hop Aphis or its variety, the Damson-Hop kind, if, indeed, it is distinguishable enough to be called a variety. It was also to be observed that almost all the specimens were on the point of passing to the winged state.

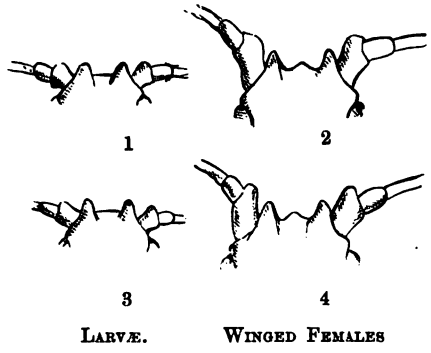
Now, looking at the history of the Hop Aphis and of the Damson-

* From this time up to about the middle of June, after long and repeated examinations, the lice of the Hop and Damson-Hop Aphis in their first stage (that is, shortly after being produced) appeared to me to be indistinguishable.

† In identifying I have mainly considered the development of the frontal tubercles, and also the form of the basal joint of the horns (antennæ); likewise the length of the honey-tubes or cornicles. Amongst the many observations sent me some few occurred which, from the specimens sent accompanying, obviously belonged to the *Aphis Pruni* of Réaumur, that is, the common "Plum Aphis," not to the kinds under observation. All communications relatively to *this kind* have been most carefully removed, as it has nothing to do with the subject; and also because it so much resembles the *Aphis Humuli* and its variety *Malaheb* in general appearance, that its presence, and especially it being obviously ready for egg-laying in late autumn, has much added to the intricacies of the subject.

Hop Aphis side by side up to this point, we find them starting at the same time in spring respectively on their several plants, continuing similarly to increase; and similarly about the end of May to gain the winged state; and up to this date, by constant microscopic examination, I did not find any difference in the frontal development of the young lice of the kinds under consideration when first produced, nor in that of the winged females.

The accompanying figures, drawn from life, show the similarity.



1, 2, Hop Aphis; 3, 4, Damson-Hop Aphis.

During June, that is, when Fly is considered (both by many Hop-growers and also entomologists who have studied the point) to be leaving the Damsons, and is certainly appearing on the Hops, specimens were still sent me; and on the 26th of June, when a correspondent especially attending to this subject reported that he could find none left on Damson and few on Sloe, I considered his observations confirmed, and likewise the theory of migration, by the fact that all the specimens he sent me were winged pupæ—that is, had embryo wings—which showed they would soon turn to the winged state, *i. e.*, to Fly.

I think this is very important, for the fact of all that remained on the sprays sent me being winged or forming wings, joined to previous departures, points to the absentees having *flown somewhere.* They had not died, or they would have been found on the bushes; they have not, as far as I am aware, ever been found infesting any other food-plants than Hop and Plum of various kinds; and with regard to these food-plants, we find the Aphides, as just mentioned, forming wings, and leaving the one set of plants just when attack is appearing on the other. Regarding migration, see 'Brit. Aphides,' vol. i., p. 74.

That such migration does take place in Aphis life we have direct testimony. M. Jules Lichtenstein indeed states that "in the greatest part of plant-lice the second form is winged, and flies away from the

place where it was born;* but just taking one or two special examples of migration from one kind or one species of plant to another, we have the common Bean Aphis or Collier (*Aphis rumicis*, Fab.), which often hybernates (and sometimes lays its eggs) on the Common Furze, and thus affects this plant both before and after the growth of its better-known food, the Field Bean.

As an example of migration to and fro on the wing from one species of plant to another, we have the Oak Aphis, *Phylloxera Quercus* (Fonscolombe), which is stated commonly to deposit its eggs in the bark of the Chermes Oak; in due course winged females appear about the end of May, and are stated *all* to migrate to the Hairy Oak, *Quercus pubescens*, whence further generations were seen, by M. Lichtenstein, to return to the Chermes Oaks in August.†

With regard to evidence of the migration of Hop Aphis (whether we call it the species *Humuli* or the variety *Malaheb*) from Plum to Hop, we have the direct statement of several competent entomologists to the effect of their knowledge of this taking place.

The German writer, C. L. Koch, in his well-known work on Aphides, states that in the last days of the month of May the Hop Aphis (*Aphis Humuli*, Schrank) are to be found in large companies on the young shoots, and on the under side of the leaves of Plum and Sloe. In these companies the writer observes that only one mother Aphis was found: *all the descendants present were either already winged individuals or larvæ of the same. Not one example of the* larva of a wingless specimen was to be found there.

After details of description the writer continues:—In the month of *June these plant-lice forsake the leaves of the Sloes and betake themselves to the wild and field Hops, where they often cover the under side of the leaves with their vast numbers.*‡

With regard to this same Hop Aphis, it is stated by J. H. Kaltenbach, in his exhaustive work on insect plant-pests,§ that the *Aphis Humuli* (Schrank) often lives from July to September under the leaves and on the upper part of the stems of the Hops in numerous companies, and that *he had found it also as early as May on the Sloes.*

Francis Walker, a well-known English entomologist, mentions that this same Hop Aphis develops on Sloes, and the second generation migrates from thence to the Hops, but returns again later on to the Sloes.||

Further, we have the opinion of Mr. G. B. Buckton, which is of

* Letter from M. Jules Lichtenstein to G. B. Buckton, F.R.S., 'Brit. Aphides,' vol. iv., p. 65.

† 'Brit. Aphides,' vol. iv., pp. 49, 50.

‡ 'Die Pflanzenlause-Aphiden,' von C. L. Koch, p. 115.

§ 'Die Pflanzenfeinde aus der Klasse der Insekten,' pp. 176 and 534.

|| 'Ann. of Nat. Hist.' xx., p. 209.

great value, both from his personal observation and from having compared and weighed the opinions of many entomologists, and he states that he considers the *Malaheb* to be a variety of the species *Humuli* (above mentioned), and that it is common on the Sloe and Plum in May and June.*

It is also stated by Dr. C. Thomas, State Entomologist for the United States of America, State of Illinois, that he considers the *Malaheb* (Fonsc.), *i. e.*, the Damson-Hop Aphis, is but a variety of the species *Humuli*.†

In all these observations I have been careful to limit them to the Hop Aphis, the *Aphis* (*Phorodon*) *Humuli*, Schrank, and its variety, the *Aphis* (*Phorodon*) *Humuli*, var. *Malaheb*, of Fonscolombe, which for convenience I call in English "Damson-Hop" Aphis; and it will be seen that in the above notes we have direct statements from trained entomologists of the Hop Aphis migrating from Sloe, and also of the *Malaheb* being only a variety of the *Humuli*.

I do not think we can trust to the observations of non-entomologists not conversant with minute distinctions of species, nor aided by powerful magnifiers, as to special cases of transference. Therefore, though with regret, I have not inserted several notes; but I certainly consider that the opinion of a large number of Hop-growers that the Fly comes to some amount on the wing from Sloe or Damson, backed up as it is by all the details above given, is a strong foundation for reasonable belief in the theory of migration.

The great difficulty as to whether the *Humuli* and *Malaheb* are to be considered distinct or not rests on how far such amount of greater development of the frontal protuberances as exists, or is considered to exist, in the *Humuli* may constitute it a distinct species. As far as I can venture to form an opinion, I join with those who think it does *not* amount to specific difference. And further, it appears to me that this marked development of the tubercles and root-joint of the horns which we see on the *Hop-lice* in various conditions in summer is an increase in development on the form that *they* bore in early spring, as well as on the form of the Damson-Hop lice.

From the latter part of March onward to about the time of the appearance of the Fly, I found that the Hop-lice had the frontal tubercles and enlarged root-joint, as figured at p. 48,‡ this sketch being a representation of large numbers sent me from infested Hop-plants,

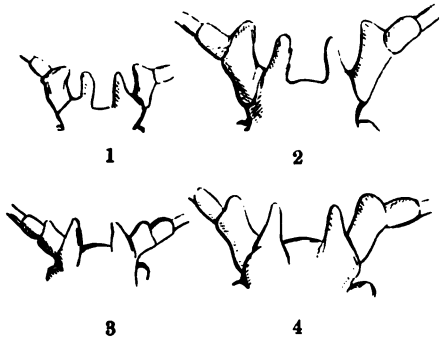
* 'Brit. Aphides,' G. B. Buckton, F.R.S., vol. i., pp. 168, 169.

† 'Eighth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois,' by Cyrus Thomas, Ph.D., p. 70.

‡ The examinations were made with inch and quarter-inch object-glasses, and, as mentioned before, with great care to remove all other Aphides besides those under consideration, and especially *Aphis Pruni*.

and I could detect no difference in form between the lice from Hop-plants and those from Sloe or Damson.

At the time of flight from the Sloes I figured the wingless females and pupæ (or larvæ containing young) from Hop-plants, and also from Damson or Sloe, and noticed a slightly greater amount of gibbousness in the root-joint of the antennæ of the Hop Aphis, but, as shown in the figures below, this difference was very slight. But, continuing



ADVANCED STAGE (? PUPÆ). WINGLESS FEMALES.
1, 2, Hop Aphis; 3, 4, Damson-Hop Aphis.

the observations after a time, I found a difference in amount of development of these frontals in some of these young Hop-lice, and, on being furnished with a supply in Hop-cones, on the 26th August, I found that the frontal tubercles and amount of gibbous form of the root-joint of the horns was more developed; in fact now (*that is, in the summer form*) they precisely resembled the typical figure of the head

Larvæ of Hop Aphis.

of the *Humuli* larva given by Mr. Buckton (fig. 1), which I copy for comparison with my own drawing (fig. 2, from a summer specimen).

From the observations--though I submit my views with great deference—I incline to think that the difficulties as to increased summer development of the Damson-Hop Aphis have arisen from observers not studying sufficiently the parallel state of the Hop Aphis at the same time.

Kaltenbach and Koch speak of it on Sloe in May and June; my own observations, both on Hop and on Sloe or Damson, began in March, and, according to what I consider the form then to be, the lice of *both* Humuli *and* Malaheb *then are not furnished with as full development as in the warm weather.*

If this be so, this appears to give the key to the difficulty, for, if *Humuli* differs as much from its own early condition as it does from *Malaheb*—and this is the main reason for considering the two distinct —the reason is removed for the distinction.

It may be worth remembering that, from the minute size of the portion of the plant-lice under consideration, the shape of these growths cannot be distinguished at all without a good magnifier; consequently they are open to many opinions, but those who hold (as there appears to me good reason to do) that the Hop and Damson-Hop Aphides are mere varieties, and to be found alike on Hop-plants in summer, may support themselves on the opinion of good entomologists of Germany, England, and America, and the practical opinion of many of our own Hop-growers. Practically, as we need knowledge of where so much of the summer attack of Fly comes from as does not come from the Hop-plants themselves, the point is of importance.

With regard to prevention of attack, the experiments tried under the direction of Mr. A. Ward on various Hop-hills, and on the acre of Hop-land at Stoke Edith Park, near Hereford, of which the use was courteously given by the Lady Emily Foley, show that the first attack caused by lice deposited by wingless females coming up from the Hop-hills in spring may be prevented by various applications, of which the following details have been reported by Mr. Ward.

On the 9th of April Mr. Ward began to apply experimental dressings to Hop-hills as follows:—

4	roots	were dressed with	paraffin mixed with ashes.
4	,,	,,	lime.
3	,,	,,	salt.
4	,,	,,	salt and lime in equal quantities,

and besides these one hill, then, like the others only just showing the tip of the shoots at the surface, or barely above the ground, was covered in with muslin. The ground round these stocks had been watered with paraffin and water, and salt and water in the previous autumn after the bines were removed.

On the 3rd of May Mr. Ward forwarded information of the commencement of his operations on the experimental acre as follows:—

315	hills	were dressed with	paraffin and ashes.
128	,,	,,	paraffin and sawdust.
218	,,	,,	paraffin, sawdust, and ashes.
63	,,	,,	paraffin and shoddy.
160	,,	,,	salt and ashes.
63	,,	,,	lime.
63	,,	,,	soot.
63	,,	,,	gas-lime and soot.
189	,,	,,	gas-lime.

The ingredients in the various mixtures were used in the following proportions :—One quart of paraffin to one bushel of ashes, sawdust, or shoddy; where sawdust and ashes were mixed, half a bushel of each to one quart of paraffin. Salt and ashes, one bushel of salt to eight bushels of ashes. Gas-lime and soot, equal parts.

The stocks were well-dressed, and the ground thoroughly covered with each kind of dressing.

Shoots were pulled off from one row (respectively) of the plants dressed with paraffin and ashes, with paraffin and sawdust and ashes, and with gas-lime. The stocks sent up strong shoots again through the paraffin dressings, but *not* through the gas-lime. On the 23rd of May these were weak and sickly, as were also the other two rows dressed with gas-lime.

Reports were forwarded at intervals, and up to the 26th of May the plants that were being experimented on remained *perfectly clean*, whereas those in other parts of the Hop-yard had been infested by wingless females and lice on the under side of the leaves. At the above date the Fly—that is, the winged Aphis—appeared, and attacked the plants that were being experimented on, as well as the others.

On this Mr. Ward justly remarks that it points to the dressings which had been applied having prevented attack *coming up from the ground;* and, further, that he considers the plants isolated under muslin having kept clean up to that date (June 24th) was owing to the above-mentioned preventive waterings which he gave to the soil round the roots last autumn.

The effect of the dressings on the health of the plants was reported at intervals, and it proved that *gas-lime* was prejudicial,—one row dressed with this was dead on August 21st. Salt, and salt and lime mixed, were injurious to some degree to the plants, but the other dressings answered well; and at the above date, with the exceptions mentioned, *all* the experimental plants looked well and were bearing well.

It is important to observe that of the plants under experiment upwards of 700 *were dressed with paraffin* applied in ashes, or in some material by means of which it could be spread on the surface of the hills, and that the plants so dressed were reported throughout as doing well.

During the last few years the serviceableness of mineral oils as insecticides, when so *combined* with soft-soap and water that they may be diluted further as may be needed for use *without risk of the oil and water separating again*, has been brought forward both in this country and also under the direction of the Department of Agriculture of the United States.

I think, however, our own method of application is the safest for the plant.

The U.S.A. plan is to add one gallon of water, in which a quarter of a pound of soft-soap (or any other coarse soap preferred) has been well dissolved, boiling or hot, to two gallons of petroleum or other mineral oil. The mixture is then churned, as it were, together by means of a spray-nozzled syringe, or double-action pump, for ten minutes, by means of which the oil, soap, and water are so thoroughly combined that the mixture settles down into a cream-like consistency, and does not, if the operation has been properly performed, separate again. This is used diluted with some three or four times its bulk of water for a watering; if required for a wash, at least nine times its bulk is needed,—that is, three gallons of "Emulsion," as it is termed, make thirty gallons of wash. Warning is given that care must be taken with each new crop to ascertain the strength that can be borne by the leafage; this of course varies with the age of the leaves, as well as the nature of the crop.

In my own experiments with this mixture I increased the quantity of soft-soap, and for Hop-plants I should consider it would be desirable to *double* the proportion of soft-soap and *lessen* that of the paraffin to at least a sixth.

An addition of some amount of paraffin to soft-soap wash has been shown to be serviceable by the experiments of Mr. Ward at Stoke Edith in 1883, and in the last season. The proportions used by him for large quantities are 12 lbs. of soft-soap and half a gallon of paraffin to 100 gallons of hot water, the mixture stirred well together and used when cool; the nearer boiling that the water is used the better the paraffin mixes. This wash is found to be very effective in killing the Aphides without injuring the plant or the burr.

Quassia has answered well in several localities as an addition to the common soft-soap wash. The Hop-bines which I examined personally in the neighbourhood of Barming in the early summer looked very clean and well after this application. The proportion used was 6 lbs. of quassia and 3 lbs. of soft-soap to 100 gallons of water.

At Rodmersham, Sittingbourne, the proportion used is mentioned by Mr. M. Mercer, Jun., as 4 lbs. of quassia and 8 lbs. of soft-soap to 120 gallons of water; sometimes equal weights of quassia and soft-soap are used to the above quantity of water, but the first solution is recommended as good.

Mr. Walter Arnold, of Frant, Tunbridge Wells, writes:—"With regard to the quantities of soap and quassia used and method of mixing, we use 1 lb. soft-soap (best procurable) to 12 gallons of water, and 1 lb. quassia to 10 gallons of water—making 22 gallons wash. We use steam from the engine for boiling the quassia and dissolving

the soap. We, however, first steep the quassia in cold water, as it is said the properties are extracted better by cold than hot water, as the heat tends to expand the wood, thus preventing the water penetrating into the chips. But we find we get a very strong extract from chips which have been previously steeped in cold water by very rapidly steaming for a couple of hours."

Taking the measure of water at 100 gallons for the sake of comparing proportions, the above quantities give from about 3 lbs. to 6 lbs. of quassia and from 3 lbs. to 4¾ lbs. of soft-soap as the proportions used. Conjecturally the great difference in amount of quassia may arise from different methods of preparing the infusion.

The remaining point of practical interest which has been brought forward relatively to the treatment of Hop blight during the past season is the introduction of washing by steam-power. Through the courtesy of Mr. Levett, and Mr. Walter Arnold, of Frant, near Tunbridge Wells, the inventors of the process, I have been furnished with details of the method of operation, of which the following is an abstract:—

The steam apparatus consists of a pump driven by a steam-engine, which pumps the water from a stream or reservoir into a large tub. From this another pump forces the water (to which the soft-soap, &c., has been added) along a one-inch iron gas-pipe. This pipe is laid between the rows of Hops, and is furnished (at intervals of sixty feet) with taps and unions, to which lengths of 180 ft. of india-rubber tubing are attached. To the end of these tubes smaller tubing is fixed, so that each 180 ft. tube is supplied with two free ends, which are furnished with nozzles, and worked in the usual way by men or boys. The amount that can be washed per day by ten jets with this apparatus is reported at 7½ acres, and the cost per acre to be somewhat less than six shillings.

As yet the plan has only been tried on a limited extent of ground, but so far it is reported to be successful. Should it prove so on more extended trial the large amount of acreage which can thus be washed per day will be a great recommendation, and, where water supply is available, the method of operation appears capable of being adapted to field use for the prevention of such other insect-attacks as we know to be checked by sudden and violent rain.

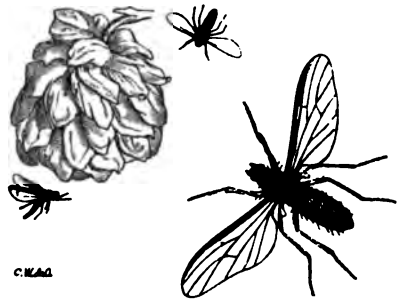
The main points shown by the observations of the season appear to be that first attack was found as early as March coming up from the Hop-hills in the form of wingless females with lice, and that this was both confirmed on a broad scale and method of prevention shown by the circumstance of the acre of Hops which was dressed in spring with various applications (specified) to prevent attack remaining quite clean (though the rest of the garden was attacked), until the "Fly"

—that is, winged Aphis—appeared. Also, there does not appear to me to be any reason to doubt that the Hop and Damson-Hop Aphis are merely slight varieties of one species, a remark which scarcely occupies a couple of lines, but which required constant examination of parallel condition of the two sorts from March to September, and which (if correct) lies at the root of the most important measures for prevention, save those above mentioned.

Amongst measures of remedy, dressings with paraffin in any dry material, by which it can be spread on the hills in spring, have been shown to be useful, and so has the addition of quassia to the washings; whilst amongst methods of washing, the application of the steam-power to this purpose opens up a possibility of carrying these operations on with a greater rapidity and less cost, of which the further proofs will be looked for with interest.

I should also add my thanks to the many correspondents through whose courtesy and likewise painstaking search I have been furnished with observations and specimens from which the above notes have mainly been taken.

Fever Fly.* *Dilophus vulgaris*, Meigen; *D. febrilis*, Linn.



DILOPHUS VULGARIS.
Female Fly, magnified and nat. size, flying round Hop-cones.

At the beginning of April specimens of larvæ were forwarded to me from Mr. Faunce de Laune, of Sharsted Court, Sittingbourne, with the information that they were found in a piece of Hop-root sent accompanying, and appeared to be feeding on it, and that the same kind of grubs were then rather numerous in the Hop-hills. The piece of Hop was partly decayed, and, on cleaning it to gain a sight of the

* As this Fly appears to be without an English name, I have retained the original one given by Linnæus from the Fly being supposed to occur in the rooms of fever patients.

state of surface, it appeared freshly injured, as if the grubs were feeding *on it*,—that is, on the live part, not merely on the decayed matter outside.

A few days later it was reported from Sharsted that, "These grubs appear to be doing much damage to the Hop plants by gnawing away the original plant, and considerable quantities of them may be found even at one stem."

These little grubs were only about a quarter of an inch in length, and like small Daddy Longlegs grubs in shape—that is, cylindrical and legless—but more prickly, and with the head brown or chestnut-coloured. These were plainly Tipulide grubs, and about three weeks later a further supply was sent, of which some were then gone on to the chrysalis stage—whitish, and which (like the Tipulide or Daddy Longlegs chrysalids) showed the shape of the insect forming within.

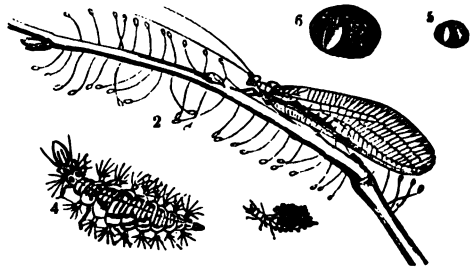
The flies began to develop about the middle of May, and proved (when submitted for examination to Mr. R. H. Meade) to be the *Dilophus vulgaris*, Meigen, a small two-winged Fly (for size and shape see figure), of which the males are intensely black; the females have the abdomen brown, and the wings brown or blackish. A second brood appears in autumn.

This Fly sometimes appears in vast swarms, and in the most various kinds of places. It will be remembered as appearing amongst the Hop-cones at Rainham, in Kent, in 1882; it has been observed in enormous numbers off the Norfolk coast: in 1862 it was recorded as hanging in millions on flowers and in bunches on grasses.

The amount of damage that it may cause is worth watching, for, as far as we see at present, it is one of the instances in which the grubs are double-feeders. They are considered to *live upon the roots of plants*, particularly of grass and corn. John Curtis, in his 'Farm Insects,' p. 467, notices this same species of *Dilophus*, then known as *febrilis*, Linn., as "exceedingly abundant every year, and the larvæ causing much damage in the gardens"; but also the grubs are to be found both in horse and cow manure, and were noted by Curtis as found in considerable quantity in "a vine border amongst the horse muck" ('Gard. Chron.' 1844).

Looking at these various points together it seems very likely that the flies lay their eggs in the manure, and thus the grubs are introduced to the roots of the plants; and if, on further investigation, the damage done to the roots prove important, it is this point (the presence of the grub in manure) which will be the one to look to first.

Lace-wings (larvæ, APHIS-LIONS). *Hemerobiidæ.*



CHRYSOPA PERLA.

Golden Eye, and stalked eggs. Larva and empty cocoon, nat. size and mag.

On August 9th I received specimens of stalked eggs from Mr. James Knight, of Hillash, near Petersfield, with enquiries as to the nature of the insect that would develop from them, the eggs "having been found suspended by a filament to the under side of a Hop leaf."

These stalked eggs (of which one kind is figured) belong to the *Hemerobiidæ*, or "Lace-wings," a family of flies of which the larvæ feed chiefly on Aphides, whence their grubs take the name of "Aphis-Lions." As these Lace-wings are of use as checks on different kinds of Aphis, and are quite large enough to be seen and destroyed if their nature is not known, the following short account of them is given, with the special observation that *they rank, like the Ladybirds, amongst beneficial insects.*

The *Hemerobiidæ*, or Lace-wings, are divided by Stephens into four genera, of which the *Chrysopa*, or Golden Eyes, and the *Hemerobius* are the most important. The figure shows one of the common kinds, the *Chrysopa perla*. This is of a yellowish green, with "golden eyes," and has long horns, and rather long and narrowish iridescent wings, which are much marked, especially down the central part, with net- or lace-like veins. These wings are turned down when at rest (see figure).

The division may be known from the *Hemerobius* by the latter having shorter horns, smaller eyes, and the wings being shorter and broader, and somewhat downy, with fewer cross-veins.

The habits of these appear much alike. The female discharges a small quantity of sticky matter together with each egg. This is drawn out in the operation of egg-laying into a long fine thread, which hardens rapidly, and thus bears the egg safely, like the head of a small pin, on the top of the slender egg-stalk.

The eggs are laid on twigs, or trunks of trees, or leaves, or anywhere apparently where Aphides which the grub will feed on, are to be found. These Aphis-Lion grubs or maggots are generally much

alike in shape—that is, long and narrowish; sometimes, as with the kind of Golden Eye figured, have tubercles along the sides furnished with bunches of hairs, which serve to support a kind of cloak formed of the skins of the Aphides the maggot has killed. The grubs are active, and wander about where their food is plentiful, and by means of their long jaws soon demolish any Aphis they attack; it is stated that half a minute is enough for them to suck out the contents of the largest Aphis, but they will also attack and destroy good-sized caterpillars, and, if no more suitable food occurs, will try their jaws on each other.

When full-fed, which is stated to be in about a fortnight, the larva spins a cocoon. These cocoons "vary from the size of pearl barley to that of a small pea, and are attached to the leaves of plants, &c.; in these they change to pupa, and in about three weeks the flies come forth in summer; but the autumnal ones remain through the winter in the torpid state."—Curtis's 'Farm Insects,' p. 78.

One species is known as the Hop Lace-wing, the *Hemerobius Humuli;* this is less than half the size of the Golden Eye (figured) in the expanse of its wings. The colour is pale ochreous, with bluish eyes, two faint rows of spots along the upper side of the abdomen, and the wings are also marked with dusky spots. Amongst the vast number of insect-plagues to the Hops it may be of service to know this insect as a friend, if it should be noticed in large numbers.*

MANGOLD.

Beet-Carrion Beetle. *Silpha opaca*, Linn.

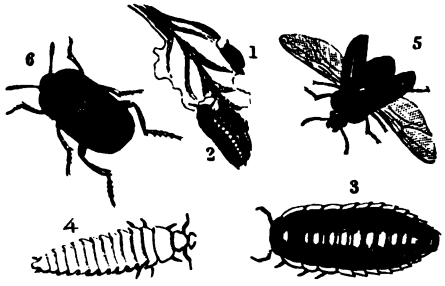
Through the courtesy of the Editor of the 'Farmer's Gazette.' Dublin, I have been favoured with the following note of the appearance of the Beet-Carrion Beetle, an unusual kind of attack in this country.

The observer, having noticed that something was eating his Mangolds at Mageney, County Kildare, examined closely, and found the damage was caused by insects, of which he forwarded specimens, *this kind of attack not having been previously noticed by him.* The fly-maggot of the Mangold had been more or less prevalent for four years, but in the present instance, though some of the plants had been only partly

* As I am only partially acquainted with the habits of the Lace-wings from personal observation, the above description is mainly given from comparison of the published accounts of John Curtis, F. Stephens, and Prof. J. O. Westwood.

eaten by the insects, the greater number had been wholly eaten away, *excepting the stems of the leaves.*

The specimens forwarded proved to be of the Beet-Carrion Beetle, the *Silpha opaca*, Linn., the grubs of which have been recorded as doing great harm in France to Beet or Mangolds; and injury was caused many years ago to Mangolds in Londonderry and Tyrone, by the grub



SILPHA OPACA.

1 and 2, young and full-grown larvæ; 3 and 4, larvæ, magnified; 5, female beetle flying; 6, male beetle, slightly magnified.

either of this beetle or one of the same nature indistinguishable from it. But, though this species (*S. opaca*) is common in England, it has not yet, as far as I am aware, been observed here as a crop-pest, and up to 1859 was stated by John Curtis "to be unknown on this side the water as an enemy to agriculturists."

This beetle takes its double name from the circumstance that its grub will feed on Beet or Mangold leaves, as well as on putrid animal matter, as dead animals, garbage, and the like, in which the beetle is commonly found.*

At present it seems uncertain how many species or varieties of these "Carrion" Beetles (*Silphas*) feed at times in the grub-state on Mangold-Beet leafage. There are certainly two kinds that do so: the brownish and somewhat downy *S. opaca*, Linn. (figured), and the black shiny species, the *S. atrata*, Linn. The grubs of the Beet-Carrion Beetle (also figured) are, when full-grown, much the shape of wood-lice, and furnished with horny jaws and three pairs of short-

* *Silpha opaca* of Linnæus, *S. tomentosa* of DeGeer (see Curtis's 'Farm Insects,' p. 392. The local varieties of the *S. atrata*, L., are given as *cassidea*, Dahl., in the Banat; *fusca*, Herbst, in Germany; *pedemontana*, Fab., in Italy; *punctata*, Herbst, Alps; *subrotundata*, Steph., in England (see Calwer's 'Kaferbuch,' p. 97). In 'Handbook of Beetles of Great Britain and Ireland,' by H. E. Cox, vol. i., pp. 409, 410, I find the *S. subrotundata* above mentioned given as a variety of *S. atrata*, and thus, pursuing the subject, get round to this kind and variety being the same as the *Phosphuga atrata* and *P. subrotundata* of Stephens, of which that writer says the former "hybernate beneath mosses, *dead* leaves, and stones, and are often plentiful in summer on sand-hills near Swansea; and the second is rare in Britain, but more abundant in Ireland."

jointed legs, and of a shiny black colour, sometimes tawny or yellowish at the edge. They feed on the young leaves of the Mangolds, sometimes clearing away the plants entirely just when the first leaves are coming up; from about the beginning to the middle of July appears the time for them to turn to chrysalids. The grubs then go down about three or four inches deep into the ground, from which the beetles begin to appear in about three weeks.

The perfect beetles may be found during winter or early in the spring sheltering under stones, or in the moss or rotten wood, or clods, &c., and are common in April in dead animals.

Where the eggs are laid from which the grubs hatch that attack the Mangolds does not appear to have been recorded. It may be under decaying matter in the field,—the *S. atrata* has been found to lay eggs "in decaying leaves, or just at the surface of the ground"; but, looking at the nature of the beetle, it seems much more likely it should be in some specially rank kind of manure, and the eggs thus be brought, or the beetles thus attracted, to the field; offal and sea-weed, or shore-refuse, are special points to be looked to, and likewise the possibility of the beetles being brought amongst decayed leaves, in which they winter.

With regard to remedy when attack is present, nothing appears to have been observed, excepting that lime and salt have both failed to be useful; but it is very likely that dressings of paraffin mixed in dry earth or ashes, or the mixture of gas-lime, sulphur, &c., recommended some years ago by Mr. Fisher Hobbs as a Turnip Fly preventive, would either of them be of service, if sprinkled when the dew was on, or on a damp day, so as to adhere to the leafage. The proportions are as follows:—One bushel of gas-lime, one bushel of lime fresh from the kiln, six pounds of sulphur, and ten pounds of soot, well mixed and powdered. To be applied early in the morning. The above is enough for two acres, and a broadcast machine is recommended as an expeditious way of spreading it.

The attack is not noted as affecting other kinds of root or "vegetable" crops. Turnips, Carrots, Potatoes, Parsnips; likewise Peas, Beans, and Cabbage are mentioned as succeeding admirably on land where Mangolds were destroyed. Therefore, if the Mangold is swept off (as sometimes happens) *in the seed-leaves*, another kind of crop could be put in *immediately*, which gets over a very frequent difficulty as to a crop-pest in possession taking everything that may be put in to the infested land. If, however, the crop has *any life* left in it, it seems best with this special kind of attack to let it stand, for the grubs only eat for a moderate length of time, and during the lull, whilst they are going through their changes in the ground, there is time for the centres of the plants to push up again and grow past danger.

This attack, if it occurs at all, is apt to be very severe, but it is so unusual that it would be well worth while to direct attention to investigating what has caused its appearance.

It has been conjectured that the eggs of the beetle may be brought in seed, but in this case it is much more likely to be in foreign than in home-grown samples.

Cockchafers. *Melolontha vulgaris*, Stephens.

MELOLONTHA VULGARIS.
Larva and pupa of Cockchafer.

On May 20th some Cockchafer grubs were forwarded to me from Smethwick, near Birmingham, which had been found *twelve* inches below the surface in garden ground, on land which had been part of an old pasture broken up the preceding year; and later in the season another specimen was sent from near Chesterfield from the bottom of a *five*-inch furrow. This was from a field that was being ploughed after having been two years in seeds.

These notes show the reason of one of the great difficulties in getting rid of Cockchafer grubs in field cultivation, namely, that they are very likely to be below the level at which they will be turned up by the plough.

The Cockchafer beetles and their injury to the leafage of many kinds of trees is well known; but, from the fact of the grubs feeding entirely underground, many people are not in the least acquainted either with their appearance or habits. These grubs feed voraciously on the roots of meadow-grass, of trees of various kinds, not excepting Fir, and they are also injurious to root-crops, as Potatoes or Mangolds, &c., if these are put into ground infested by these long-lived grubs. The eggs are laid some six inches or so below the surface of the ground, and the grubs come to within a short distance of the surface to feed; but go very deep down, far below ploughing depth, in winter, and it is not until their fifth year that they develop to the perfect beetle.

The above sketch gives a figure of the Cockchafer grub when full-grown, showing its large head, with strong horny jaws, and the three pairs of jointed legs. The colour is white, with head, jaws, and legs

of a yellow or rusty colour. The end of the tail is bluish, from the digested food showing through the skin, and is somewhat enlarged so as to have a swollen appearance. The chrysalis or pupa is like the perfect beetle, with the forming limbs folded below it.

The Cockchafer in England, and various kinds of Chafers in Canada, Ceylon, and other parts of the British possessions, are so destructive in their grub-state that any information of practical methods of keeping them in check would be very serviceable.

With regard to the powers of destruction of an individual grub, I found by experiment that one about three-quarters grown, placed with an uninjured Mangold root, had by the following morning gnawed a hole half an inch across and three-eighths deep; by the following morning it was large enough for the grub to lie in; and on the next day the burrow had been so far extended under the rind that the grub was out of sight, having thus cleared out a burrow about an inch and a quarter or more in length, and half an inch across in about three days.

From experiment made with a mixture of mineral oil (kerosine) and soft-soap, it was plain the grub could go down into the ground quite fast enough to avoid any harm even from this strong insecticide. Shaking down the beetles from trees on to cloths and destroying them, or shaking them down to pigs, gets rid of great numbers; but with regard to the grubs, no way seems practicable—or at least known of—for getting rid of them, excepting disturbing the infested surface of the ground, *when the grub is near the top*, and having these grubs hand-picked or killed by droves of pigs; or sometimes, amongst tree-roots, turning over the surface with stout wooden pegs and clearing the grubs, answers well.

More information is greatly needed.

Mangold and Beet Fly. *Anthomyia Betæ*, Curtis.

ANTHOMYIA BETÆ.

Beet Fly and pupa, mag. and nat. size; head and eggs, mag.

On the 26th of August I was favoured with the following communication from Mr. Watson Hornsby, of Abbey Town, Holme

Cultram, Cumberland, which I wish particularly to draw attention to, as, in addition to valuable notes on cultivation, it gives reliable information as to the appearance of the Mangold maggot as a crop-pest, having been noticed in Cumberland several years before the date at which it was generally observed. Mr. Hornsby writes :—

"Acting on the permission kindly given in last week's 'Agricultural Gazette,' I venture, as a Mangold grower of some experience, to trouble you with a few remarks on the above.

"I observe in your notes that you speak of 1880 as being the year, 'so far as you are aware,' when the *Anthomyia Betæ* was first observed as a crop injurer. It would appear, however, that the insect has proved itself a pest to Mangold growers in Cumberland several years previous to the one you name. In 1876 the Mangolds on the farm I then occupied were much injured by it, but this was the first year that I had noticed the maggots in the leaves, although for some years previous to that the leaves of the young Mangold plants had presented, at certain stages of their growth, that shrivelled-up appearance which is a sure sign of the attack of the maggot; and I have no doubt now that it was so, though at that time the injury was ascribed to other causes, frosts, &c. The attacks, however, were *not very severe or general until 1876*, since which the Mangolds have suffered heavily every summer; so much so, indeed, that in many districts they have been dropped out of cultivation in a great measure, only a few patches being grown in situations peculiarly adapted to their growth. The attacks usually take place during the first two or three weeks in June, and again about the beginning of August; the second attack, however, does not do much injury generally; indeed, if the Mangolds are flourishing and inclined to get much leaf, I have sometimes thought the second attack did them good by ridding the plants of some of their leaves and letting in the air and sun to the roots,—at all events, I have known the roots thrive very rapidly afterwards. The first attack, however, is often nearly fatal to the crop.

"I have noticed a somewhat curious fact in connection with the attack of Mangold Fly, and that is, that on the east side of a north and south fence the Mangolds for a considerable distance are nearly clear of attack, although in the middle and east side of the field the maggot may be very numerous, and the higher the fence the more shelter it seems to afford from the attack. I cannot say that I can altogether account for this, but probably you may be able to throw some light on the question.

"With reference to prevention and remedial measures, I should recommend *good cultivation, autumn if possible, a free use of fertilisers, and I consider a liberal application of salt or potash, salt, or both, to the land intended for Mangolds as a* sine quâ non *in Mangold growing.*

Treatment of the foregoing kind will, I think, prove the best preventive. I have tried dusting of several kinds on the plant, but without perceiving any benefit; but a good drenching of paraffin and water I have known undoubted good results from. The difficulty is in applying the latter, as the mixture requires constant and quick stirring during application, or the paraffin will come off by itself."

Mr. Jabez Turner, Norman Cross, Peterborough, also favoured me with the following note on autumn cultivation :—" I am still in favour of *autumn manuring* for Mangold,—in fact, on strong land I do not think the land should be worked in the spring, except with a horse-hoe. This will in most cases give sufficient tilth, and the condition of the manured soil will force the plant beyond the attack of the Fly."

On the 17th of June Mr. D. Byrd, writing from Spurstow Hall, Tarporley, Cheshire, mentioned :—" Our crops of Mangolds are very badly affected; we have not done anything to them this year, and the only manure used is farmyard manure of a richer quality than is usual."

A number of the Mangold leaves were enclosed for inspection with regard to minute objects found on the back of many in the field. These proved to be the white oval or spindle-shaped eggs of the Mangold Fly, with the reticulated surface, as shown in the figure.

The eggs in many cases had hatched, and were mere empty films, the maggot having made its way into the substance of the leaf by boring a round hole into the skin, through which it had gone, dragging part of the egg-shell with it into its passage.

Many of the leaves were already blistered by the maggots working within. On Nov. 8th Mr. Byrd mentioned "that the same kind of eggs were to be found late in the summer under the largest leaves without causing any perceptible injury to the Mangold";* and further observed that, considering the very dry season, his root-crops were fully equal to those of former years, although he did not use guano or artificial manure to stimulate growth, but depended entirely on farm manure; and remarked :—" We feed our cattle liberally with cake and corn, which give rich manure; and we also use dry soil to absorb the liquid manure, and fix the ammonia, making the whole more valuable."

The above note seems to me to point still in the same direction as the others, namely, that good cultivation and rich strong manuring, such as that noted, carries the crop through attack, but that, whether farm manure attracts the Fly or not, the attack is sometimes to be found badly where only farm manure is used.

* This is in part because the old plants with large leafage suffer less from attack, and probably in part because the maggots are not able to bore through the skin of the leaf so readily as earlier in the year.

With regard to methods by which paraffin may be applied as a wash without the difficulty occurring that is mentioned on p. 61 of the paraffin and water separating, the reader is referred to the U.S.A. plan, mentioned at p. 54 under Hop Aphis, by which paraffin or other mineral oils may be so thoroughly combined with soft-soap and water that the mixture can be further diluted with water to the strength needed without separating again. As far as my own experiments go the method of mixing answers, but the strength that is safe to use of course requires experiment.

The following recipe, however, for a simple and effective method of making a mineral oil solution is the best that I have met with. The proportions and plan of mixing were worked into this practical form by the late Mr. Alex. Shearer, while at Yester, Haddingtonshire, who was a clever chemist as well as an able and intelligent gardener. The method has now been tried for some years, and found safe as well as serviceable, and is in regular use under the superintendence of Mr. Malcolm Dunn in the Gardens of the Duke of Buccleuch at Dalkeith Palace :—"To eight parts of soft water add one part of black (soft) soap, and boil briskly for a few minutes until the soap is thoroughly dissolved. While boiling add paraffin, or any similar mineral oil, and boil for a minute or two longer, when the whole will be thoroughly amalgamated,* and, if bottled and securely corked while warm, it will remain so, and be fit for use at any time when required. The strength of the solution of course depends on the amount of mineral oil in it, and it can be easily reduced to the proper power by mixing it with soft water as it is wanted for use."

Mr. Malcolm Dunn gives me the following notes as to the method he finds most convenient for mixing the application :—"In practice I boil the proper proportions of soap and water together, and when ready I fill this into ordinary wine-bottles, which have been placed in boiling water. The bottles are about half-filled with the lye, and then the paraffin is poured into them, *two gills* being put into each bottle. The bottles are then filled up with the boiling lye, corked at once, and stored away for use.

"When required for use a bottle of the mixture is poured into a four-gallon watering-pot, which is filled up with soft water, and is ready for use, at a strength of one wine-glass of paraffin (*half a gill*) to one gallon of water."

Mr. Dunn further notes that the important point is the proportion of the soap and water :—"*Eight parts water and one part soft-soap thoroughly amalgamated* form the lye which *takes* mineral oil, and

* For field use the immediate application would save all need of storing. For garden use the arrangement of bottling saves much risk from careless workers, as the exact amount to be used can be given out.

thoroughly amalgamates with whatever proportion of this may be added,—that is to say, the paraffin may be put into the boiling soap and water in any quantity, and the whole will mix together of an equal strength throughout. Heat helps much in quickly producing thorough amalgamation of all the ingredients, and hence I have stated that they should be mixed in a *boiling state.*

"My object in using common wine-bottles for mixing the lye and paraffin is, for one thing, they cost me nothing, and the cost is not heavy in any case; but further, by having two gills (four wine-glasses) of paraffin in each bottle the men can make no mistake in using it at the proper strength. By using one bottle of the mixture (containing four wine-glasses of paraffin) in an ordinary four-gallon can, the mixture is at the rate of one wine-glass of paraffin to a gallon of water, and so on.

"Few plants in a *green state* will stand a strength of four wine-glasses (two gills) *to the gallon,* but at the same time *it is not necessary to use it so strong for even Scale insects,* the most difficult to kill of all ordinary plant-pests.

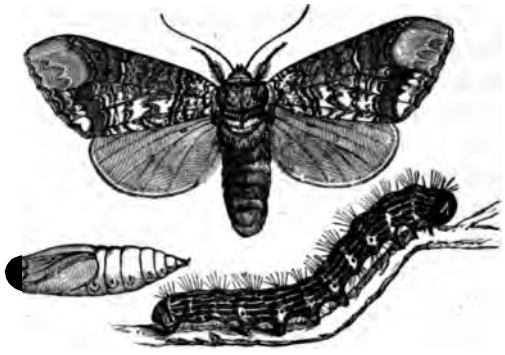
"One wine-glass full of paraffin to a gallon of water is strong enough to kill Aphides, and such soft insects; two wine-glasses for Thrips, and three wine-glasses for Scale is our 'regulation' strength. The tender young fronds of ferns and the *young green growths of most plants will not be safe if over one wine-glass to the gallon is used.*

"This mixture is such a safe, cheap, and easily applied remedy for insect-attack that a knowledge of it must prove a boon to many who have their crops annually destroyed by insects."

The above recipe, which has now been in use with success for some years, will probably be of service for a large number of attacks on bush-fruit trees (as for Gooseberry caterpillars, &c.), and (at least in garden cultivation) for Aphides on Cabbage, Carrots, Turnips, &c.; but I place it under the heading of Mangolds, as this is one of the regular field-crops to which paraffin solution has been successfully applied in the case of leaf-maggot, and would have been more used but for the difficulty of keeping the paraffin permanently mixed.

OAK.

Buff-tip Moth. *Pygæra bucephala*, Stephens.



PYGÆRA BUCEPHALA.
Buff Tip Moth, caterpillar, and chrysalis.

The caterpillars of the Buff-tip feed on the leafage of various forest trees, as Elm, Oak, Lime, &c., and sometimes are found on fruit trees.

On the 19th of August Mr. Angus M'Intosh forwarded specimens of this kind of caterpillar, then about three-quarters grown, from Llanerch, Llanelly, South Wales, with the note that they had been found the previous day attacking young Oaks in the nursery. Mr. M'Intosh observes:—"They had, when I noticed them, entirely stripped two or three young trees of their leaves, and then were clustered together on the twigs in much the same way as the Pine Sawfly caterpillars on Scotch Fir, and were doing their work quite as thoroughly. They are very voracious. I tried soapsuds on them, and I think from the results it is just the thing to destroy them with; it sticks into their hairy coats so effectually."

Further on Mr. M'Intosh reported that he had destroyed the companies on the young Oaks, and noticed the habit these caterpillars have of falling to the ground when disturbed.

When young these Buff-tip caterpillars are gregarious; they feed together in parties, and (*vide* Newman's 'British Moths') "are readily found by the devastation they cause. Each brood fixes on some topmost outside branch of Elm, Lime, Hazel, or other tree, for this species appears a very general feeder, and, completely stripping off the foliage, leaves the twigs as bare as in the depth of winter."

When the caterpillars are out of reach, a sudden jar, such as is given by throwing sticks at the infested boughs, will make them fall in great numbers, and, when once down, trampling on the fallen grubs

and putting a tarred band round the base of the trunks of the forest trees, so that they could not make their way back again, would be a thorough cure. For young trees in nurseries Mr. M'Intosh suggests that some sticky fluid or mixture [? Davidson's composition, Ed.] would be of great service.

The caterpillars are somewhat downy, yellow or tawny, marked with black lines, or long black spots interrupted at the joints, so as to give the appearance of upright orange streaks at intervals, and have black heads. They come to their full size, which is an inch and three-quarters long (see figure), from August to September, and then come down from the tree and change to brown chrysalids either on the ground or amongst roots or rubbish just at the surface. The moths from these come out in the following June, and are large and prettily marked. The head and fore part of the body between the wings is yellow, and the abdomen mostly pale yellow. It has the fore wings of a silvery grey, with various markings of black and rusty colour mostly placed in single or double lines, and with a yellow or ochrey patch at the tip, whence the name of the moth. The lower wings are whitish. The eggs are laid early in June or July.

I have seen the caterpillars do great damage in the neighbourhood of Isleworth, and the attack appears to be just one of those which may be very often got rid of by a little trouble, but which will be likely to do a great deal of mischief if not attended to. Shaking down the caterpillars and killing them when fallen, together with such measures as will keep them from crawling up the tree again, will get rid of a great many; and soft-soap washes (for various kinds of which see Index) would be of great use in clearing them off low trees or in nurseries.

ONIONS.

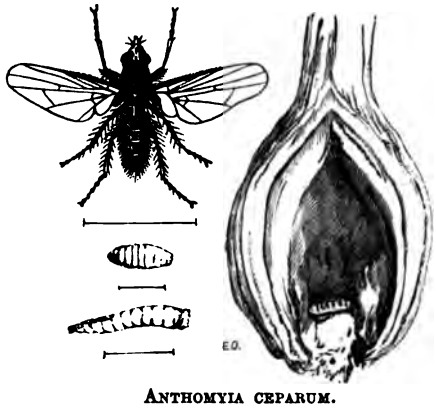
Onion Fly. *Anthomyia ceparum*, Curtis.

During the two seasons previous to 1884 I experimented on the effect of covering Onion bulbs up to the neck (or rather higher) with earth, so that the Fly could not get at the bulb to lay its eggs; and, on the small scale on which I was able to work the plan, I found it answer so well that during last season (1884) I again tried the plan of burying the Onions, but on a more definite method, and met with great success.

The principle of the arrangement was, that as the flies usually laid their eggs on the bulb itself (especially the lower part, and beneath

it if exposed), by burying the bulb safely away, so that the flies could not get at it, we preserved it from attack. The flies *must* lay their eggs somewhere, and if they cannot get at the right place (for them) to lay them in, the eggs must be dropped where they either will not hatch or the maggots will perish. I have found the eggs in such cases laid too far up the leafage of the Onions to do any mischief, or merely dropped on the ground.

On Jan. 25th, 1884, I had a trench dug as if for Celery, and in this, good manure was laid and covered over with a few inches of earth.



ANTHOMYIA CEPARUM.

Onion Fly, maggot, and pupa; magnified. Pupa in stored Onion. Lines showing nat. size.

At the usual time in the spring I sowed Onions along the trench, disturbing the soil as little as possible, and also sowed Onions in the bed alongside. As the plants grew I had the earth from the sides of the trench gradually worked down upon them, which kept the bulbs fairly buried throughout the season, and also kept down the weeds. The row of Onions next the trench was also kept more or less covered, as the earth lay conveniently for spreading over the bulbs.

The Onions in the trench throve remarkably well; those by them did well, but not so markedly; and on Sept. 10th, when the crop was raised, those from the trench gave a yield of sound and good bulbs, many of them very fine, and throughout the season there had been scarcely any attack of Onion Fly on these. This plan of growing in trenches could not be carried on easily on a large scale, but it has succeeded so well that this season I purpose growing my crop this way; and it appears to me that in many cases it would answer well to have the beds slightly ridged for Onion growing. The ridged earth can readily be worked on to the bulbs, and, besides direct protection from fly-attack, which (as far as I can see from three years' experiment) is afforded, much good is done by the weeds amongst the Onions being smothered

by the successive earthings; as, instead of the bulbs being thrown loose in the ground and exposed by the operation of weeding, they are more firmly fixed. With regard to the effect on the plant-growth in this way, all the root-fibres were preserved, which are often much knocked about in hoeing, and also the surface at root-level was kept from being dried in the hot sunshine, and the result was all that could be wished in quality of bulb.

PARSLEY.

Parsley "blight." (? caused by insect-attack or fungus).

On the 1st of November, Mr. W. W. Glenny forwarded some roots of Parsley from Barking, with the observation the crop had failed, as Parsley had never done on that farm before, and drew my attention to the appearance of "rust" on the roots, with the enquiry whether the injury was of insect origin. He further noted:—

"This Parsley was sown early in March and germinated freely; the crop flourished, and was hoed over twice, and in June some plants were thinned out and bunched for market. Dry weather set in, and the crop began to fail, *the leaves becoming parched or seared*, the mischief being charged to the excessive drought.

"This was difficult to comprehend, as the soil was in good condition and of a cool character; showers followed at intervals, with no improvement in the foliage, and in the middle of November the Parsley was still suffering.

"Similar dying off has been often noticed in the winter and attributed to dampness, but Parsley has not been so affected in the summer in this district."

A similar failure was observable in field-grown Parsley near Isleworth, and likewise in my own garden the leaves (as Mr. Glenny describes them) became yellow and sear, and the plant perished. On examining the roots I found patches on them where the bark was injured and decayed or "rusty," but on repeated and careful examination I did not find any "rust grubs" present such as produce the well-known disease caused by the larvæ of the "Rust" Fly, *Psila Rosæ*, in Carrots and Parsnips; and on consultation it appeared likely that this troublesome disease was of a fungoid nature, very probably caused by *Peronospora*, allied to what is commonly known as Potato disease.

It is mentioned by Mr. Worthington G. Smith that the *Peronospora nivea*, Ung. (*P. umbelliferarum*, Casp.), affects various umbelliferous

plants, but is especially formidable in its attacks on garden Parsnips. "Like other species of *Peronospora* it causes putrescence in the plants it attacks, and sets up decay in the leaves, stem, and roots. . . . In the Parsnip the large fleshy esculent roots become spotted, and at length putrid," &c.*

In roots I examined the spotty condition was very marked, also the end of the root was often rotted away; and Mr. Glenny's note connects the disease with Parsnip presence being previously on the ground. He says:—"Brown streaks or marks may be seen on the roots, and, as the crop followed Parsnips, *which had suffered severely from rust or canker*, it is probable that the plant, being of a like character to its predecessor, may have fallen a victim to some germs or spores remaining in the land. The field had been under cultivation for Parsnips for some years, that crop coming every third season, and the canker had so developed itself recently that Parsley had been sown instead."

The first examinations having been all with regard to insect injury, what now appears the probable cause was not made out in time for determination this season; but, waiting complete information, it may be observed that in either of the above cases it would be desirable not to let Parsley follow Parsnips; likewise, that infested plants of either kind should be burnt to destroy the enemy, whether it should turn out to be "rust" maggot, or, as is much more likely, *Peronospora*, propagated by spores (equivalent to fungus seeds) in leaf and stem or root. Further, a dressing to infested ground, such as would kill the "spores" or maggots, as the case may be, which in either case would be near the surface of the ground, would be certain to do good.

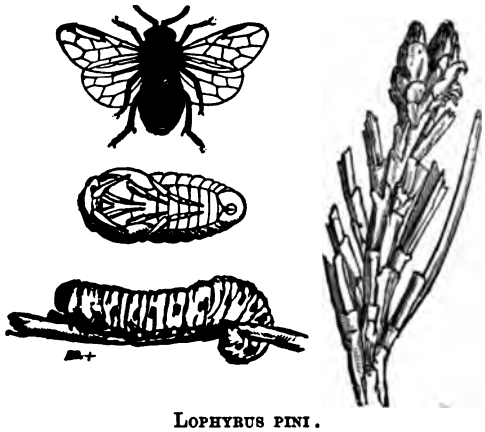
A good dressing of caustic lime or caustic gas-lime, with due care as to quantity, would be sure to be serviceable. With regard to gas-lime, I have a note of a very good crop of Parsley following its application; and at present in my own garden I have plants of autumn-sown Parsley thriving well on a line of ground which was well watered with soft-soap and kerosine (see p. 54) a short time before sowing, and where gas-lime was afterwards thrown amongst the young plants.

This attack causes so much inconvenience to Parsley growers that further information as to its origin and prevention would be gratefully received.

* See 'Diseases of Field and Garden Crops,' by Worthington G. Smith, p. 239. This little volume contains such a large amount of useful information, profusely illustrated with figures of microscopic fungi, that I add the publisher's name—Macmillan & Co., London.

PINE.

Pine Sawfly. *Lophyrus pini*, Curtis.



LOPHYRUS PINI.

Pine Sawfly, pupa (taken from cocoon), and larva; magnified. Pine leaves injured by Sawfly.

On the 14th of July Mr. W. E. Cattley, of Edderton, Ross-shire, wrote to me regarding an unusually severe attack of Pine Sawfly caterpillars, and his communication is of great interest, as he gives an observation of the summer brood of caterpillars developing to Sawflies early in September.

Possibly the existence of this summer's brood in Scotland, as well as in Germany, may be known to foresters. I have had a few or solitary specimens of summer cocoons, and also an observation of the attack of caterpillars at Darnaway, Forres, having suddenly vanished in the early part of July, 1881, after a cold wet day; but otherwise nothing possibly bearing on this subject has previously been sent in by the contributors to these Reports, and the subject is of much importance relatively to methods of prevention of attack.

Mr. Cattley observed:—"Six or eight years ago I enclosed a portion of moor—say seventy acres—and planted it with Scotch Fir and a few Larch. The ground rises so that the upper end is about 200 ft. above the lower. The trees at the lower end are about 5 ft. high, and those at the upper end 1½ ft. to 2 ft. high.

"The first I saw of the caterpillar, which I take to be *Lophyrus pini*, was three years ago, but they were then few. This year they have increased alarmingly, and I have kept two men for a fortnight killing them with paraffin or crushing them with a thick glove. But they are fairly beating me; and among the smaller trees, at the upper end they have stripped the trees like a swarm of locusts.

"In some instances they have spread on to the Larch, but not in such close phalanx as when at work on the Scots Fir. I took a branch or two home, and enclose the chrysalids of two which changed in the house. They appear whiter and flatter than the plates show.

"I have never been able to catch the flies; when I have seen them they have darted down through the tree and sheltered themselves in the rank heather at the root. In the belts where grass and not heather covers the soil they appear in small numbers. They attack the Austrian and Corsican Firs as readily as the Scotch.

"I am persuaded that where the trees are small, up to 8 ft. (that is to say, forty acres, about 200,000 plants) they will not survive."

On July 30th Mr. Cattley sent me the following note, which well describes the complete disappearance of even a widespread attack of caterpillars when the time has come for their change to chrysalis:—

"I was absent from home for a fortnight, and on my return the caterpillars had completely disappeared; no doubt they had spun and hidden somewhere. But where? My men and I sought them high and low, and only found two esconsced within the whorl from which the leader shoot of a Fir, 5 ft. high, had sprung. We searched also in the deep heather, 1 ft. or 1½ ft. high, at the root of the tree, and did not find one.

"One thing that I remark is that, though the tree may be stripped bare in all other respects, the terminal shoots both of leader and laterals being the growth of the year, is never touched by the caterpillars."

Later on (Oct. 15th) Mr. Cattley wrote further with regard to the above habit he noted August 25th:—"A few clusters of Sawfly caterpillars are seen on the Firs. They now feed on the shoots of the year, which the spring brood avoided.

"These latter grubs are much larger than the early lot which had disappeared; they are paler in colour, and sometimes yellow. I carried a cluster home, and fed them till they changed to the cocoon. The cocoon is like the spring lot, except that it is one-half larger"; this was at the end of August. On Sept. 6th some of the previous lot of Sawflies had come out (of the summer cocoons), the males smaller and sparer than the females, with broad comb-like antennæ and black in colour; "and after these had come out I found *scores of empty cases not in the ground, but in the rank growth of heather.*

"The late batch of caterpillars go, like the early ones, in close phalanx, as close as they can place themselves. There is not one group of these for a hundred of the early lot. To-day (Oct. 15th) not any are to be met with, but I have seen them within a fortnight.

"Trees that have been attacked for years in succession have a dwarfed and tufty appearance, but I have not often found them killed

outright. Where the Aphis and Sawfly both attack the same tree I think it is generally fatal."

The development of Sawfly caterpillars is subject to extraordinary variety, both of date of the time when they leave off feeding and of duration of time before they develop into Sawflies, which may occur in two or more years after that in which they went into cocoon. The following quotation from the 'Forst Zoologie' of Dr. Bernard Altum gives a clear account of the dates of change when the broods take place in one season :—

"The Sawflies are found at two different times in the year—in April and July. Larvæ are found in May and June, when they feed on the Pine leaves of the previous year. They turn to pupæ in the beginning of July, and after two or three weeks develop into Sawflies (or in August or September). The larvæ from these live on the Pine leaves of the present season, and (quite differently to the first set, which form their cocoons on twigs or Pine leaves, &c.) these go into cocoon in the earth. Here the caterpillars lie in cocoon the whole winter through without becoming pupæ until spring, a period of nine months for the metamorphoses, which happened so quickly previously.

"However, *all* winter cocoons do not belong to the caterpillars of the second generation; it often happens that there is *only one generation*, and the caterpillars of this hybernate in the ground in cocoons."*

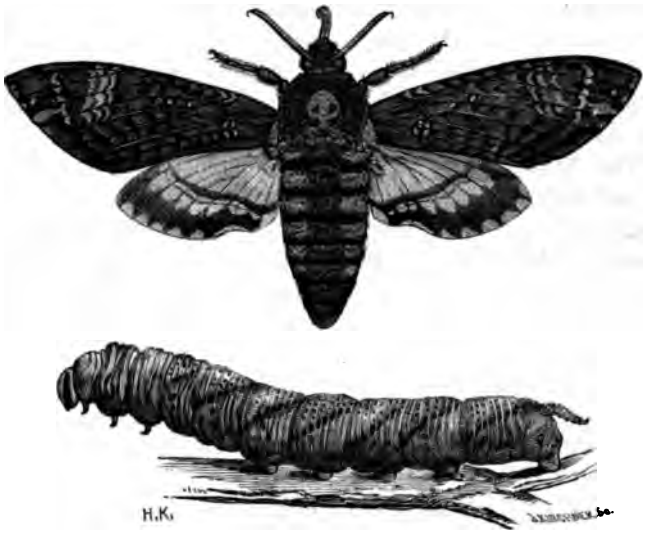
There may be difference in detail, as, for instance, the second set of caterpillars feeding to some extent on the old Pine leaves, as well as those of the previous season, or going into cocoon under moss or surface-rubbish; but the above quotation gives a good description of the general history where there are two broods, and agrees well with Mr. Cattley's observations.

The knowledge that when there is a sudden disappearance of the Sawfly caterpillars in July, that it is very possible they will be found in cocoons on the twigs or on heath or low-growing plants beneath the infested trees, may be made very serviceable. The cocoons may be pale grey or black, or drab, about a quarter of an inch long, and of a blunt oval or rounded shape, and if the heath, or whatever it may be on which the cocoons are formed, is cut and burnt, a large part of the second brood would be destroyed. If the caterpillars instead should have gone under surface-rubbish, this might, as before noted, be gathered up and collected in heaps and burnt.

* 'Forst Zoologie,' von Dr. B. Altum; Insecten, Part ii., p. 269.

POTATOES.

Death's Head Moth. *Acherontia Atropos*, Curtis.



ACHERONTIA ATROPOS.
Death's Head Moth and caterpillar.

During the past year specimens of caterpillars of the Death's Head Moth were sent from two localities.

These splendid caterpillars are of the shape figured above, and when full-fed grow as much as four or sometimes five inches in length. The colour is usually yellowish, with the back spotted and tubercled with black, and the sides marked with seven pairs of blue or lilac stripes. Each pair slants backward so as to form a kind of point on the back, and the lowest end of the stripe is variously marked with white or white and black. The distinguishing point, however, of the caterpillar is a kind of tail-like horn at the extremity. This is tubercled, bent down, and then slightly turned up again at the tip.

These caterpillars feed on various kinds of plants, as the Elder, Spindle tree, and others, but their favourite food is the leafage of Potatoes. They usually do not feed until evening, and from their great size, if they chance to occur in large numbers, they cause very considerable damage.*

The greatest recorded appearance I know of is mentioned by Stephens, of nearly a bushel of the chrysalids being procured from the

* For accounts of this moth see 'British Moths,' by Professor J. O. Westwood, vol. i., p. 9; and 'British Entomology,' J. F. Stephens (Haustellata), vol. i., p. 114.

Potato fields near Ham, in Essex; and also an observation sent to myself some years ago of such a numerous appearance of the moths at a locality on the Cornish coast as to be a serious annoyance by coming to the lights at night. They are chiefly noted as occurring across the southerly part of England, but I have had a specimen from as far north as Stanger Gill, Thurso, Caithness, N.B.

The caterpillars are full-fed about August and September; they go down into the ground and turn to chrysalids some depth below the surface. The moths usually appear about October, but it has been stated that those that do not turn to chrysalids till late remain unchanged until next spring.

The moth is a splendid creature, sometimes from four to five inches in the spread of the wings. These are variously marked with rich brown, orange, and black, and the hinder wings are orange, with dark bands; but the moth may be best known by the scull-like mark on the back, whence it takes its name.

Where these caterpillars are numerous enough to need attention, the best plan to get rid of them is to observe which plant is attacked, and then look for the caterpillars either amongst the leafage or beneath the surface of the ground by the plant. The grub usually rests by day, and comes out to feed in the evening and night; from its great size it is easily observable in the bright late summer or early autumn moonlight, and could be then got rid of by handpicking; but (if any remedy is needed) probably stirring over the ground by the attacked plants with a stout pointed wooden peg would be the best way to find and get rid of the creature.

As these caterpillars are somewhat rare, and their finders usually desirous to see what they turn to, I may add I have never had any difficulty in rearing the moth by simply placing the caterpillar with a supply of its food on a bit of garden ground under a wire gauze dish-cover (any old one answers the purpose). Thus the caterpillar can, when full-fed, bury itself as deep as it pleases, and be quite undisturbed in quite natural circumstances till it changes, when the gauze cover imprisons it for its owner.

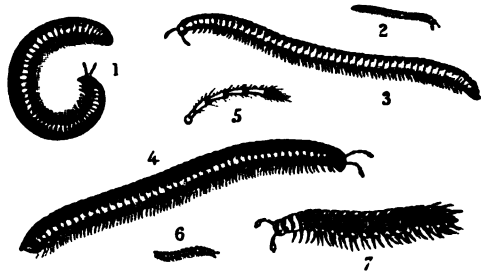
False Wireworms; Julus Worms; Millepedes.

Julidæ; Polydesmus.

The Julus Worms or Snake Millepedes, and the flattened Millepedes (figured), all known under the name of False Wireworms, do so much harm to various kinds of root-crops, as well as to Wheat, that it is difficult to place them under any special heading.

At Spurstow Hall, Tarporley, Mr. D. Byrd found the flattened Millepedes early in November attacking the Magnum Bonum Potatoes.

He mentioned, on Nov. 8th, that a portion of these were attacked by Wireworm-like creatures piercing their way into the tubers, and when the Potatoes were lifted these grubs (so to call them) were to be seen half-buried in them, but, on being exposed to the air, they drew themselves out and fell to the ground.



JULIDÆ; POLYDESMUS.

1, *Julus Londinensis;* 3, *J. guttatus* (*pulchellus*, Leach); 4, *J. terrestris;* 5, horn; 7, *Polydesmus complanatus;* all magnified; and 2 and 6, nat. size.

The specimens sent showed that the attacker was the *Polydesmus complanatus*, figured above. The Potatoes were pierced as if by large shot-holes, and the Millepedes were still feeding in them.

A little later on (Nov. 27th) specimens of the same kind of Millepede were sent me, together with samples of the Wheat they were attacking, from near Princes Risborough. Curtis says of this kind, "This is reported to be by far the most destructive species;" and he mentions that in April considerable numbers of the smaller ones were detected eating the roots of Wheat; and likewise in November, young Wheat, which was going off when grown to about half an inch to an inch in length, was found to have this same kind of False Wireworm swarming round the grains, which were much injured. The doubt was whether they fed on the grain before or after it became in a sickly state, but from subsequent observation it may be presumed it did so in both conditions.

Specimens of the "pink-spotted" Julus Worm, *Julus guttatus*, were sent from the Gardens, Farm Hill Park, Stroud, by Mr. Charman about the middle of November, with the note that this kind of Millepede was becoming quite a pest. He mentioned:—"I found them in ripe fruit of Strawberries last year, and this year *in almost all root-crops*, Potatoes, Onions, and Celery."

Mr. Arthur Ward, writing from The Gardens, Stoke Edith Park (with the observation that his remarks refer mainly to garden crops and manure used in the garden), notes:—"I have not the least doubt that a great many of the insect-pests are carted or wheeled on to the land with the manure, especially from what gardeners term the

'rubbish heap,' where a great quantity of green refuse gets thrown together with leaves and sweepings, &c., from the garden.

"I have always noticed this kind of soil (after all has become decomposed) to be full of insects, of which *the greater part are the Julus worms*, and these attack Potatoes, Carrots, and Onions; and this year I find great numbers of them on late Celery. Such soil ought not to be used for at least two years, during which time it should be well turned over, and plenty of lime mixed with it."—A. W.

"The Snake Millepedes are general feeders, consuming both decaying and living animal and vegetable substances. They prey upon slugs, small snails, insects and their larvæ and pupæ, earthworms, &c. . . . . They also feed on living vegetables, and various plants are often injured by their attacking their roots. In particular they feed upon our root-crops, Potatoes, Carrots, &c."—'Aptera,' A. Murray, p. 16.

These Millepedes continue in their somewhat caterpillar-like shape throughout their lives. At first they have only three pairs of legs; this number is increased afterwards with the moults of the skin, but they do not go through changes of form, and never get wings; consequently, in many cases it appears beyond doubt that they were brought on the ground in the manure. They lay eggs about Christmas, so that thorough disturbance of the soil, such as takes place in winter digging in gardens, would be good treatment, and they are said especially to thrive in undisturbed dampish ground.

The London Snake Millepede, *Julus Londinensis*, Leach (fig. 1), is about an inch long, blackish or of a dark lead-colour, with about eighty pairs of whitish legs, looking to the naked eye like a fringe on each side of the creature. This is recorded as being found infesting roots of Wheat in Surrey, but we have not notes in any of these cases of whether the Millepedes were noticed doing harm to the preceding crop. The Snake Millepedes do not arrive at full growth or propagate till they are two years of age, so that, unless brought on the land in manure, it seems likely that the attacking Millepedes or their parents would have been noticeably at work in the preceding crop; and, in further observations, any notes of what might be seen in manure when applied, or other notes, would be very serviceable, for the treatment of this attack has been very little studied.

The common pink-spotted *Julus* may be collected in great numbers by large pieces of cut Mangolds; I saw it thus in May swarming on pieces of root at Sharsted Court, Kent. The only application which has as yet been reported as entirely successful as a remedy is salt, which was noted in 1883 by Mr. J. Addison, Mapledurwell, as being an easy way of killing them; and he also found they were attracted to cotton-cake.

RASPBERRY.

Red Maggot; Gall Midge Maggot. ? *Lasioptera Rubi*, Heeg.

On the 2nd of November a packet of Raspberry twigs was forwarded to me by Mr. C. Whitehead, of Barming House, near Maidstone, with the note that they had been forwarded to him as being infested with some plant-pests in the places abnormally swollen.

On examination these stem-galls or swellings proved to be inhabited by one or more maggots of the same nature as the Red Maggot of the Wheat Midge, noted at p. 31, though differing from it in gall-making habits. It was impossible to name the species from specimens still not advanced beyond maggot-state, but the description of the injury caused by the *Lasioptera Rubi* (Heeg.) corresponds almost precisely with the condition of the specimens sent.

It is stated by Kaltenbach that these grubs (the larvæ of the *Lasioptera Rubi*, Heeg.) live in companies in woody stem-galls, and are to be found in Raspberry stems. The reddish maggots cause round swellings of the stem, in which they lie apart from each other. *The galls which remain through the winter produce their flies* in the spring (see 'Die Pflanzenfeinde, Insekten,' p. 238). The flies reared from galls of the above kind by Kaltenbach himself were considered by him to be of *Lasioptera argyrosticta*, Meig.

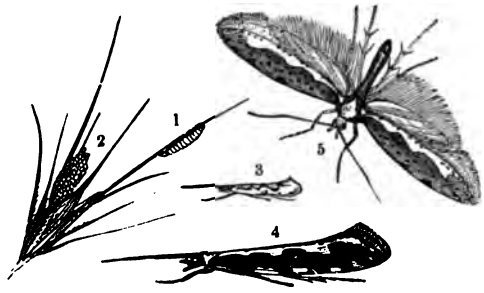
The exact species of what we have cannot be settled without seeing the fully-developed insects; but, judging by what appear to be its habits, it appears that increase of the attack might be quite checked by carefully cutting away all the stems that bear these roundish swellings or galls on them before the time at which the flies or midge-gnats come out in the spring, and carefully destroying these galls. They should all be burnt, not on any account thrown to the rubbish-heap, or the maggots in the galls would develop to midge-gnats just as perfectly there as on the stems.

It would be very desirable to stamp out an attack of this kind at once, or it might increase to a cause of serious loss in bush-fruit farming; and there is no difficulty in making sure whether it is present by just cutting through a swelling or two to see whether there are maggots within.

This attack is also found on the stems of one and possibly of several kinds of Brambles; therefore, clearing away Blackberries—that is, Bramble plants—from hedges near Raspberry grounds would be very desirable.

TURNIP.

Diamond-back Moth. *Plutella cruciferarum*, Doubleday; *Cerostoma xylostella*, Curtis.



CEROSTOMA XYLOSTELLA.

1, caterpillar; 2, eggs; 3—5, Diamond-back Moth, nat. size and mag.

The Diamond-back Moth caterpillars have again appeared at some of the same localities where they damaged the Turnip leaves in the previous season. Notes of their life-history were given in the Report for 1883, with a few observations showing that—whether or not nitrate of soda or other stimulating dressing carried the plant over attack when it was fairly established—it was certain that a weak growth threw it under the power of the caterpillar.

On August 8th, 1883, it was noted from near York, relatively to this attack, "that there were bad accounts from some farms in the district up to a week before,—the Turnip plant had been looking very weak from the wet cold weather"; in 1884, from the reverse (from dryness and heat) it is open to supposition that the Turnips were checked from this cause, and certain that at Kipling Cote (one of the localities reported from) the soil at sowing-time had been in exceptionally bad state for the operation (see Turnip Fly, p. 84),

The only remedies which appear to act are nitrate of soda, or such dressings as may drive on growth, and sometimes sweeping the plant with boughs fastened on a scuffler, or sending sheep through the field, —in short, the remedies which are used for Nigger or Turnip Sawfly caterpillars. It certainly, however, seems as if something might be done in the way of *prevention*. The caterpillars spin up both on the ground or on their food-plants, whether these are crop-plants or common weeds mainly of the Cabbage kind, such as Jack-by-the-Hedge, Hedge Mustard, &c., and the autumn chrysalids do not change to moths till spring. It does not seem at all likely, looking at what occurs in regular course of husbandry to Turnip leaves, and to the

land on which the Turnips grew, that any large amount of cocoons *could* remain on the field uninjured. The leaves are destroyed; if the Turnips are fed off on the land the cocoons would quite certainly be crushed or smothered, and, if merely ploughed in, it is probably they would be killed, their nature being to lie on the surface in the air.

It seems to me therefore that this attack probably comes from the caterpillars on neighbouring wild plants. In 1883 Lord Walsingham favoured me with a note of the Diamond-back caterpillars having been seen by him in great numbers feeding on the fine-leaved Hedge Mustard or Flixweed (*Sisymbrium Sophia*), and, as this plant is to be found on rubbish-heaps by roadsides and the like places, "except in the extreme north of Scotland," it might be well to watch next season whether it was one of the weeds of the regularly infested districts.

On the 19th of August Mr. W. Tait, of Broomend, near Inverurie, N.B., forwarded a package of leaves of Swede-Turnips taken at random from a four-acre field at Crichie (near Inverurie). Mr. Tait wrote:—

"I did not see a single Turnip, and hardly think I could have seen a single leaf, that was not affected more or less like those sent. I saw a considerable number of moths. When at rest they seemed of two kinds (both *Tineæ*), a few apparently all cream-coloured, but the great majority seemed to have a cream-coloured back (or inner margin) with the rest of the wings dark brown. [The Diamond-back Moths are variable in colour.—Ed.]

"I have never seen such a plague before. I ought to have said that the margin of the field and a few missed drills are sown with *yellow* Turnip, but they are only slightly affected."

The specimens sent me proved to be of Diamond-back Moth, and on the 26th of August Mr. Tait, writing further, mentioned he had captured some of the moths, and identified them as Diamond-backs (by Stainton's 'Mannal.") He observed:—

"I could only lay hands on one larva; they seem all to have *spun up* on the back of the leaf, but it was too wet to make a very extensive search. I have seen several fields during the last day or two in different localities all more or less affected"; and Mr. Tait noted that by report he considered the attack must be *general over the north-eastern district of Scotland.*

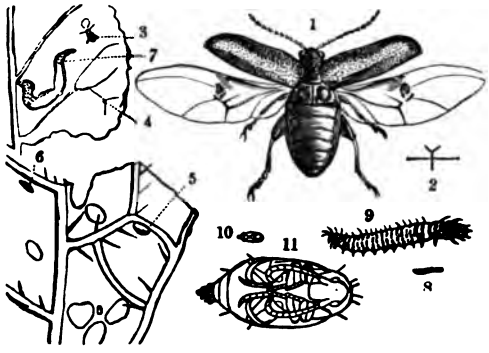
On August 15th Mr. James Thomas forwarded me specimens of Diamond-back caterpillars from North Otterington, Northallerton, Yorks, with the following note:—"Up to the 1st of August I had a most beautiful prospect of a splendid crop of Swede-Turnips, but about that date a kind of blight came upon them, and now the crop of *ten acres is almost* dead. On examining the leaves [a sample of which was sent—Ed.] I find they are nearly all perforated to a considerable

extent, and there are large numbers of a small green worm, of what kind I cannot tell, but I am persuaded that the little green worm is doing all the mischief. The bottom or under leaves are faded green, and the top leaves are blue, same as sample enclosed. The land on which the Swedes are growing is very fine light soil, and had a good crop of Barley on last year. It was manured with fold-yard manure last autumn, and had about 5 cwts. of mineral superphosphate sown with the Turnip seed about the first week in May."

Mr. E. Riley, writing from Kipling Cote, Market Weighton, on July 14th, said:—"I am sorry to tell you that the Diamond-back Moth has again made its appearance among the Turnips about a week ago, and I think in larger numbers than last year"; and on the 18th of August it was further reported, from the same locality, "the caterpillar of the Diamond-back Moth is very busy amongst the White Turnips and Rape."

On the 2nd of August Mr. Henry Stourton, of Holme Hall, York, noted:—"I have seen a good many Diamond-back Moths about, but as yet I have not seen any caterpillars."

Turnip Fly. *Haltica* (*Phyllotreta*) *nemorum*, Curtis.



HALTICA NEMORUM.

Turnip Flea Beetle, eggs, maggot, and pupa; nat. size and mag.

Mr. T. H. Hart sent me the following note from Kingsnorth, Kent; and I think it is of interest both in drawing attention to the fact that Turnip Fly does sometimes injure the rough leaf (a circumstance not enough considered), and likewise in the account of the seed lying dormant until the heavy rain came and started it into good growth.

Mr. Hart says:—"Turnip Flea was very troublesome in the spring and early summer. Cottagers' plant-beds were swept off, as also in many cases early-sown Turnips and Swedes. One of my neighbours

had to plough up about five acres of Swedes and resow. Notwithstanding that I got a splendid seed-bed the ground was too dry for the seed to germinate. A plant here and there came up, and for some time it appeared as if they would be allowed to stand; but on July 7th and 8th the insects came in a swarm. In a few days the younger plants were reduced to a stump, *while those with rough leaves were so disfigured as to be almost unrecognisable.*

"The Flea continued to devour the young plants as they came up till the heavy storm of July 24th, when 1·10 in. of rain fell in seven hours, after which we saw no more of them. This rain brought up the bulk of the seed after lying in the ground four or five weeks, and, although rather late, I am thankful to say I have a very nice piece of Swedes and Turnips without resowing."

Mr. P. Loney, writing from Marchmont, Berwickshire, on the 19th of June, observed:—"We were wonderfully free from all insect-pests last year [1883, Ed.]. The Turnip Fly was absent; in no case did we hear of or see a field where it was in any numbers to cause anxiety. But this year (1884), where stubbles were late in being ploughed, they are present.

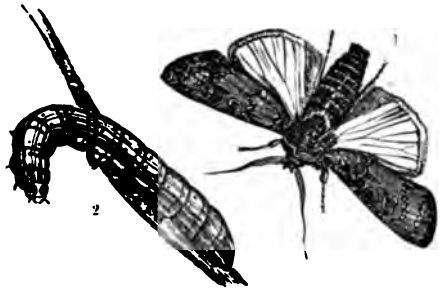
"A striking case of this came under my notice a few days ago. A field of twenty acres, half of which was ploughed in the autumn, the other half in the end of April,—the field was all wrought together, and sown with Turnips. The *late ploughed half is very bad* with the fly or flea, whilst on the *other half scarce an insect is to be found*, clearly pointing to the advantages of early ploughing."

Mr. E. Riley, writing from Kipling Cote, Market Weighton, on July 14th, mentioned that "the Turnip Fly is still singularly destructive. I never remember seeing it so voracious in July. We generally consider all danger past when July comes in, or before.

"I never saw Turnips 'go in' in a worse condition as regards the soil. May and June were very dry; the land worked what we call very 'knotty,'—that is, no fine mould,—all the top soil for two inches deep being the size of nuts or walnuts—nothing kindly—and *such shelter* for the Fly. There is every prospect of a bad Turnip crop on the high wolds."

Mr. Riley's note of the weather and consequent bad state of land at sowing-time deserves attention, for it confirms what is so strongly laid down of the importance of a good start and healthy growth in pressing ahead of insect-attack.

"Surface-Caterpillars," or larvæ of **Turnip Moth,** *Agrotis segetum,* Westwood; **Heart and Dart,** *A. exclamationis,* Linn.; and **Yellow Underwing,** *Tryphæna pronuba,* Linn.

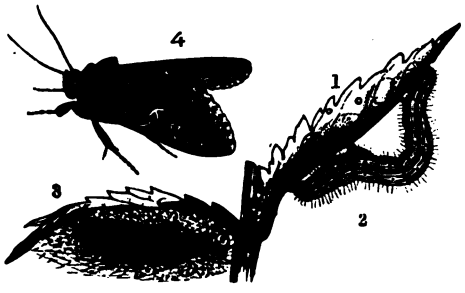


AGROTIS SEGETUM.

Common Dart Moth; 1, moth; 2, caterpillar.

Various kinds of the caterpillars commonly known as "Surface-caterpillars" did more harm than usual last year, probably in part for the reason suggested by Mr. Glenny that the season was so dry that the plants had not power to grow well past attack; also the warm and settled weather would be favourable to the moth, and the young caterpillars would not be materially lessened in number by the heavy rains, which sometimes are of great service in checking moth-caterpillar ravage.

We had an instance of this in 1879 in the great appearance of the Silver-Y or Mangold Moth, *Plusia gamma;* it was noted that the caterpillars, which were very numerous about the middle of August near Maldon, in Essex, "were destroyed in immense numbers by the persistent downpour of rain."



Mangold Moth, caterpillar, and chrysalis in cocoon.

Damage was reported last year from the Surface-caterpillars of three kinds of moths, of which the general habits are much alike: the Dart or Turnip Moth, *Agrotis segetum;* the Heart and Dart Moth, *A. exclamationis,* also very injurious to Turnips; and the Great Yellow Underwing Moth, *Tryphæna pronuba.* The size, shape, and markings of these various moths and caterpillars are given by their respective figures.

The moths are to be found about June, the caterpillars for the most part feed at night, and hide themselves by day sometimes under stones or clods, and, when winter draws on, bury themselves beneath the surface, or feed according to circumstances of weather or otherwise, and in spring come out again to feed. When full-fed, which may be between March and July (or in the previous autumn with *A. exclamationis*), the caterpillars turn to brown chrysalids in the earth.

The various caterpillars may be generally described as of a smoky purplish or greenish colour, greenish or paler below, with brown or ochrey heads, and variously striped or marked, as figured, with various shades of brown. They all have the habit of rolling themselves in a ring when disturbed. The Turnip Moth caterpillars are distinguishable from the Heart and Dart caterpillars, often found with them, "by being very horny and shining, which is much less the case in *A. exclamationis*."

The caterpillars of the "Turnip" or "Dart" Moth were the most common last year. These grubs are said to feed at first mainly above ground, and, by gnawing through the plants at ground-level, do enormous mischief very rapidly. When they are older they remain under-ground, or come up at night to feed; and the place where they are may sometimes be known by the sticking out of a piece of Turnip leaf from the burrow, down which it has been dragged for consumption during the day. They are known to feed on almost all our root-crops, and likewise on the roots of corn and grass; but this year notes were sent in, with specimens accompanying, of their ravages amongst Celery and on a four-acre piece of Squills; and (on the small scale on which it could be noted in my own garden) I found injury from them amongst young Cabbage when just put in after Onions.

The first appearance of Surface-caterpillars was mentioned by Mr. W. W. Glenny, writing from Barking on the 27th of March, as follows:—"We have had plenty of the Cabbage grub marching about lately, which is an uncommon outcome of a mild winter. These insects generally hide themselves just under the surface, and do most harm in August, nipping off the small seedling plants when they are young and tender. I never noticed them so lively in February before."

On Sept. 4th Mr. Glenny forwarded an account of the unsatisfactory following up of the unusually early appearance:—

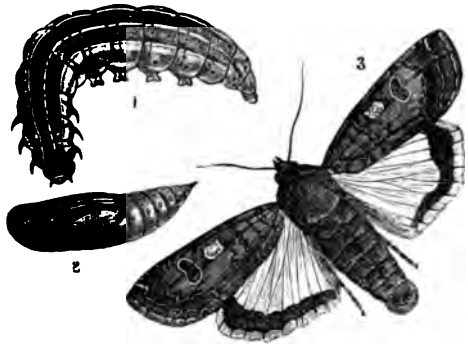
"Surface-caterpillars have been exceedingly destructive, especially amongst the Cabbage seed-beds. The long continuance of drought caused the seed to germinate at irregular intervals, and the young plants came up slowly. This gave an advantage to the foe, who attacked the single plants as they appeared above ground. Morning by morning it was easy to mark the work of devastation that proceeded without interruption during the night.

"Plots of ground where early Carrots have been cleared, or land adjoining such plots, are particularly liable to attack.

"If the seed-bed abuts on land as described, you may even in passing note a zigzag edge, which shows plainly how the vermin travel from one plot to another. It leaves a wave-like appearance to the side of the field as the insects eat their way into the crop.

"The most effectual way of checking them is to hunt for these caterpillars just below the surface periodically, say twice a week. By these means the attack may be lessened, and a crop saved.

"This year, having been dry, the caterpillars have given much trouble amongst transplanted Leeks, and one field of about four acres was searched more than once; the result was satisfactory, large numbers were destroyed, and the crop in the main saved. In dry seasons like this the plants grow slowly, and the mischief done is more apparent; whilst in damp seasons the rapid increase of foliage makes the damage less noticeable."



TRYPHÆNA PRONUBA.

Yellow Underwing Moth; 1, caterpillar; 2, chrysalis; 3, moth.

Specimens of Surface-caterpillars, sent by Mr. Glenny on October 27th, proved to be of the Turnip Moth, *A. segetum*, and the Great Yellow Underwing, *Tryphæna pronuba*, figured above.*

* These Yellow Underwings are much oftener observed than the grey Turnip Moths, by reason of their bright yellow under wings, banded with dark brown or black, from which they take their name, and which make them very noticeable as they rise, towards the latter part of summer, before the passing foot in recently-mown grass or low-growing plants. Their chief time of flight is, however, in the evening or night; they lay their eggs in some quantity at the root of various kinds of plants. The caterpillars hatch in about a fortnight. By day they lie hidden, rolled into a ring in the earth under their food-plants, or sheltered under clods, stones, or the like, and come out at night to feed. The lumps of dirt and gnawed leaves show their whereabouts. During the winter months they may be found near the surface of the ground, and in spring they come out again and feed. When full-fed in the late spring or early summer they bury themselves and turn to chrysalids,

Mr. Glenny notices, in one of his communications, that, though "they cannot be seen on the surface, they are easily found by noticing where a blade has been cut off, and then moving the soil gently."

On August 13th Mr. Riley sent specimens of the Turnip Moth caterpillars, *A. segetum*, from Kipling Cote, near Market Weighton, where they were attacking the Turnips.

On August 14th Mr. J. T. Edge, of Strelley Hall, Nottingham, forwarded specimens of caterpillars of the same species, *A. segetum*, and also of the roots of young Swede Turnips eaten off by these grubs, with the following good observation of habits:—

"The grubs appear to attack both Swedes and White Turnips; they are found an inch or two below the surface close to the Turnip root; they have a burrow up to the surface, where they attack the Turnip, eating it off just level with the ground. I have found as many as four grubs at the root of one Turnip. We have not observed this destruction of Turnips till to-day, but the grubs are now doing a great deal of damage. I observe the Rooks seem to like them."

On August 14th Mr. James Craig forwarded specimens of caterpillars of the same kind of Turnip Moth, mentioning:—"I enclose along with this sample of grubs infesting Turnip field; the crop is fast going with them.

"On one end of the field I put a cart-load of gas-lime, and on the other 2 cwt. of crushed rock-salt. These two ends are not so badly infested as the midde of the field, where only the manure was put; this was 18 loads of farmyard and 6 cwt. bag manure per acre. The grubs are found in the soil under the plants."

On Sept. 16th specimens of Surface-caterpillars were forwarded from East Hull, near Brandon, Norfolk, by Mr. Upcher, with inquiry as to their nature, and the remark "that they eat the Turnips quite through just below the surface of the soil; they seem to work the drills out regularly, and have destroyed several acres in one of my fields."

On Sept. 23rd Mr. H. C. Bowen forwarded specimens of the caterpillars of the Turnip Moth from Chesterton, Bridgnorth. These had destroyed about half an acre of Cabbages, and were in such numbers that a boy could pick up a hundred in a very short time. The previous crop was Potatoes, for which the land had been well-limed.

This caterpillar—that is, the Turnip or Dart Moth caterpillar—is noted for feeding on almost every plant not too hard for its operations, but I am not aware of Celery having been up to the present time

from which the moths come out about the middle of the summer. See, besides other authorities, 'Praktische Insecten kunde,' of Dr. E. L. Taschenberg, Part iii., p. 151.

included in the list; the following note, however, points to a good deal of damage being caused by it.

The following communication was sent to me on October 7th by Mr. Cheesman, Secretary of the Natural History Society, Selby, Yorks, with specimens of the caterpillars accompanying, which I identified as the *Agrotis segetum* :—

"I send two larvæ, which my gardener tells me are the cause of the remarkable flagging of the Celery in this district. As many as from one to a dozen roots in succession in the row may be observed with drooping and flagging leaves, and on the plant being touched it is found that the roots (or rather the solid rootstock) are quite eaten away, as if by mice. But I am told it is the work of the grubs which I send, they going from root to root and making considerable destruction. I saw the two grubs taken from the ground at the end root of about a dozen which had been eaten."

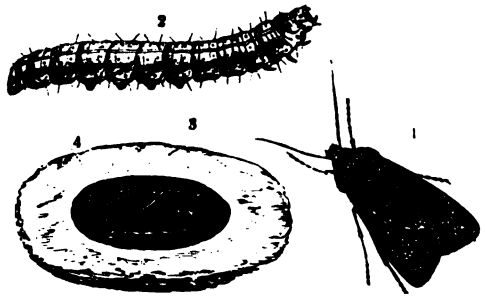
On Dec. 18th Mr. Cheesman further noted:—"Early in October I sent you some larvæ of *Agrotis segetum*, which were making great havoc in the Celery gardens in this neighbourhood. From that time until now the destruction has been going on; first the outer leaves are observed to flag, and in a short time the whole of the plant is eaten through at the collar just beneath the surface of the ground. I notice the plants are attacked in succession from root to root in the same row, and are not taken indiscriminately."

In a case like this it appears to me that searching for the caterpillar near the surface where the injury to the leaves shows its presence could not fail to be of service. Also, where attack was *regularly* and strongly advancing, it would be desirable to break the continuousness of the row. If a couple of yards or less of the Celery was dug up and the trench filled across towards the end nearest the plants to be protected with some good shovelfuls of ashes well sprinkled with paraffin or fresh gas-lime, such of the caterpillars as were not previously removed with the Celery would almost certainly be killed, or prevented advancing.

The caterpillars noted below appeared to be of the Heart and Dart Moth, *Agrotis exclamationis*, Linn., which also is very injurious to Turnips, and also sometimes found in large numbers in Potatoes. This is somewhat flatter than the Turnip caterpillar, and not so shiny (see fig. on next page); but the specimens were not in a condition in which I could absolutely identify them.

Specimens of Surface-caterpillars, which appeared to be of *A. exclamationis*, were forwarded from Hewletts, Cheltenham, with the mention that the Rooks destroyed the Turnips by pulling them up when searching for these grubs. Where the caterpillar has gnawed through the tap-root, very slight disturbance is enough to draw the bulb out of the ground.

On Aug. 28th the Rev. J. C. Clutterbuck enclosed Surface-caterpillars, with the mention that they were then much injuring the



AGROTIS EXCLAMATIONIS.
Heart and Dart Moth, caterpillar, and chrysalis in earth cell.

Swedes and Turnips, and, when the plants were quite small, ate quite through the root; likewise that the Rooks destroyed a good many.

On September 15th specimens of injured Swedes were forwarded, showing the power of the bulb of recovering damage when attack ceased, or weather or other favouring circumstances set in.

Mr. Clutterbuck wrote accompanying:—"I send you some specimens of Swedes attacked by the grub: the smallest one was finished off last night, as you see it. You will see that some of the other roots are likely to recover.

"We find that they are affected worst in places under trees, and where the ground was dryer. The larger roots show marks of the grub, but they are now growing fast *after the rains* of a week ago, and I have no doubt that the Rooks destroyed a great many grubs. Some persons blamed the Rooks for rooting up the Swedes, but I have no doubt they were after the grubs. . . . . I have some roots now which seem quite to have beaten the grub now, with the help of the Rooks, and will be a fine piece of roots."

The following short observations as to the good effects of salt and artificial manure given by farmers in Weybread parish, situated on the north of Suffolk, were forwarded to me by the Rev. J. H. White, Weybread Vicarage, Harleston; not having permission to use names, I give them simply as memoranda:—

"White Turnips sowed after a heavy farmyard manuring on a piece of lightish land. Result, total failure of crop. At the same time, on an adjoining piece of the same field, he sowed the same sort of White Turnips after an application of artificial only. Result, good crop. Salt mixed with manure considered would be beneficial as tending to destroy any grubs or maggots that might be deposited in the manure.

Sowed a considerable quantity of salt and then applied farmyard manure to a piece of land, and, after ploughing in, sowed White Turnips: this was on light land. Result, a first-rate crop. General opinion that salt consolidates too much to answer on heavy land."

With regard to prevention of spring attack from caterpillars which have hybernated, or have in some way or other lived through the winter where the crop has been on the ground continuously, probably as yet the only method of checking attack is the well-known one of turning the grubs out of the ground by a body of workers sent with strong-pointed sticks, or any other implement, and collecting these and destroying them. But where ground is known to have been infested in autumn, and it can be worked, it is best treatment to *stir the surface well.* The caterpillars which are within reach of operations will then be exposed to weather influence, which will act strongly on them, although it would not in ordinary amount of cold have done them any harm in their own naturally-formed or chosen shelters. In the course of the past winter I turned some Surface-caterpillars out from the ground in which they had been buried for experiment, or had buried themselves last autumn, and found them in a condition in which they would certainly have soon died if left on the surface.

From state of weather or other circumstances there may be exceptions here and there, but as a rule the plan of a thorough stirring will act well. Thorough cultivation of the surface also destroys the weeds which feed or shelter the grubs, and therefore is a good measure in summer on a field where the crop has been destroyed; and chemical dressings which will annoy the grub are of use. The two treatments joined greatly help to clear infested land by starving and poisoning the pest.

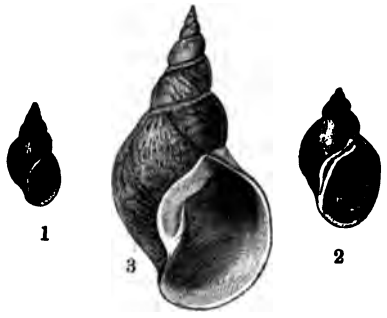
MARSH SNAILS.

Wandering Marsh Snail, *Limnæus pereger*, F. & H.; **Truncate Marsh Snail,** *L. truncatula*, F. & H.; **Pond Marsh Snail,** *L. stagnalis*, F. & H.

The amount of the presence of Marsh or Water Snails is a subject which might most usefully be inquired into relatively to one or more kinds of Water Snails (or *Limnæus*) being the "host" of the liver-fluke of the sheep in its early stage.

The life-history of the Fluke and its connection with the *Limnæus* are given in minute detail by the long and profound research of Prof. A. P. Thomas, F.L.S., in the 17th and 18th vols. of the Journals of

the Royal Agricultural Society (new series), with some observations as to its prevention; but independently of the anatomical and veterinary aspects of the subject some amount of inquiry is sent to me occasionally regarding the presence of, or means of getting rid of, the Snails; and the appearance of these common Water Snails does not seem to be so well known as is desirable. The figure is therefore



WATER SNAILS.

1. *Limnæus truncatulus*; 2, *L. pereger*; 3, *L. stagnalis*.

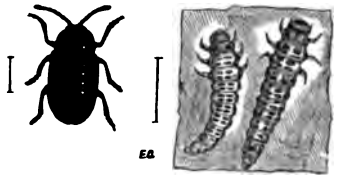
given of the *Limnæus truncatulus*, which is considered to be the species most infested in the early stage of the Fluke, and the *L. pereger*, sometimes but apparently not so often infested. The *L. stagnalis* is merely added, as, though I am not aware it is a "host" for Fluke, its comparatively large size conveys the appearance of this genus of shells more plainly.

These Water Snails (*L. truncatulus* and *L. pereger*) wander about, and may be found in the damp grass, as well as in pools; but it is stated of *L. truncatulus*, "*It deposits its spawn on the mud*, which is its usual habitat, and, *not like its congeners*, on the stalks and underneath the leaves of water plants."—'British Conchology,' vol. i., p. 117, by J. Gwyn Jeffreys, F.R.S.

During the years in which I had personal knowledge of *Limnæus* at Sedbury Park, Gloucestershire, they were excessively prevalent in small field-ponds or drinking-places, where floating water plants, weeds round the bank, and more or less mud, according to weather or season, gave every encouragement to their increase. Clearing the shallow pools of weeds, and removing the broad band of weed-grown or stagnant mud from the entrance end of the pool, would have certainly at once greatly lessened the quantity of Water Snails, and it may be conjectured also that of rot in our sheep, which were constantly affected to a serious extent; and if in the course of the coming season I should be favoured with any notes of field and pond treatment found useful in lessening these living shelters of the early stage of the Fluke, I should be glad to insert them in my next Report.

WILLOW.

Willow Beetle. *Phratora Vitellinæ*, Linn.



PHRATORA VITELLINÆ.

Willow Beetle, caterpillars, and eggs, magnified; lines showing nat. length.

The Willow Beetle, *Phratora Vitellinæ*, Linn., is a small oblong-oval, shiny beetle about the sixth of an inch long, of a bronze or green or bluish tint above, more brassy below. These beetles come out in the spring from their sheltering places, and feed on the leaves of various kinds of Willows, also of Poplars. Later on the caterpillars or grubs hatched from the eggs of these beetles continue the mischief.

These whitish spindle-shaped eggs are laid in small patches on the surface of the leaves,—whether invariably on the under surface, as in the case of those sketched above, I do not know. The eggs are protected by a loose transparent membranous film. The caterpillars which were forwarded were about half an inch long when full-grown; pale yellowish or whitish, with black head; the segment next the head nearly all black above, and a squarish black mark above the two last segments of the grub; the intermediate segments variably marked with black, amongst which a more or less interrupted series of black marks down the back and black spots on the sides, largest on the three segments next the head, were the most noticeable.

These grubs feed on the under side of the skin of the leaf, working right through until the upper surface is only a film, which dries and cracks away. When full-fed the caterpillars *turn to chrysalids in the ground*, and from these a second attack of beetles comes up in autumn.

The beetles sent were of various tints, and I incline to think the

Phratora vulgatissima, Linn., was present amongst them, but this does not affect the matter practically.

It will be seen by the following notes that one of the main points to be worked on for *preventing* attack is that of *the beetles wintering under old or loose Willow bark, or uuder rubbish on or near Willow grounds*, and, in short, like the nearly-allied "Mustard-seed" Beetle, in any snug shelter, but especially such as is formed of rubbish of the plant which is its summer food.

On the 21st of May Mr. Cosmo Melvill wrote from Kersal Cottage, Prestwich, relatively to the Willow Beetle, *Phratora Vitellinæ*, which had then lately made its appearance in extensive Willow beds at Lymn, Cheshire, and was becoming so alarming a nuisance there in its inroads on the Osier beds as to call for unusual exertions to withstand it, and information as to what could be done to extirpate the pest was asked in behalf of the growers of the locality.

On the 28th Mr. Melvill further mentioned that every day the ravages of the insect were extending, and they were *being carted away in bushels*. Paraffin was then being used, and "apparently with some success." The following note regarding the widespread nature of the attack was forwarded :—

"For some weeks past the Willow growers in Lymn, Statham, Thelwall, and other places in Cheshire, have been troubled by the appearance, among their Willow beds (some of which are extensive and very valuable) of numbers of beetles which threaten to destroy all the Willows in the neighbourhood, unless the means that are now being tried prove effectual. A meeting was held at Lymn for the purpose of considering the best means of exterminating the pest, and a resolution was carried which pledged the growers present to continue the use of paraffin oil, with the object of catching the beetles. By this means one grower has caught some millions in one day, and it is believed if this course is followed up the crops will be saved."

On the 29th of May, Mr. H. Cameron, writing from Lymn, Cheshire, informed me that the Willow growers in that district, who were suffering from this insect scourge, had formed themselves into a society for mutual protection and interchange of experience. Of this society Mr. Cameron was the chairman. He informed me that :—

"The remedies hitherto tried (but so far with little success) are dusting the young shoots with hellebore powder, soot, sulphur, lime, and spent gas-lime. *The plan now adopted is to hand-pick, or rather shake off, the insects into small vessels containing a small quantity of paraffin oil.* This plan has been steadily carried on by many of the Willow growers during the last fortnight *with marked success ;* but unfortunately a few people take little or no notice, and I fear these neglected lots will pollute the surroundings.

"I am disposed to believe that Paris-green, which you recommend, would be a likely cure." [On trial (as noted subsequently) this application proved useful.—Ed.]

On the 31st of May, Mr. Cameron further informed me that at a meeting held the previous evening most of the gentlemen present reported a great diminution in the number of the beetles, but that he found, on going over the Willow beds before writing, that there were still great numbers left.

Relatively to the sheltering of the beetles during winter under any old bark or similar rubbish at the Willow grounds, which is a most important point in consideration of how to get rid of them, Mr. Cameron remarked:—"Some of our members inform me that during last winter they found a large number of the perfect beetle under the rough bark of the Willow trees, and one grower, who has a wooden hut erected on his Willow field, found, on accidentally removing some of the boarding of this, that the beetles were wintering there in numberless quantities.

"Another informs me that he has found them largely under the bark of old fencing-posts, old boards left lying on the ground under the flood-line, &c.

"This being known, I think some means of trapping during the late autumn or early winter might be devised and prove useful.

"As regards area of land under Osiers, I am not very wide of the mark in saying we have about fifty acres in the Lymn district, and I dare say the adjoining parish of Thelwall, which is affected as Lymn is, will grow a like acreage.

"If the means adopted for the destruction of the beetles do not prove effectual, the money loss in Lymn alone will be very serious this year; but the loss does not end with the season, as Willows, once denuded of the foliage by the beetle, never do any more good, so that three years' crops are lost, besides all the expense of cultivation and replanting of the land.

Willow leaf partly eaten by Willow Beetle.

"The plants are usually put in rows about twelve inches apart each way, and the Osiers are cut down, as a rule, close to the old stock, say ten inches above the ground, every autumn; but occasionally lots are left uncut until the autumn of the second year. In this case I fancy syringing [*vide* remarks on Paris-green, Ed.] would have to be resorted to in order to reach the tops of the shoots with any dressing which might be applied."

On the 25th of June Mr. Cameron noted further, relatively to estimate of value of Willow crop:—

"I mentioned that there may be about fifty acres of Willows grown in Lymn district, and I feel pretty certain that unless means had been taken early to suppress the beetle, the whole crop, on an average, I am told, worth about £1000, would have been lost. The sum, however, means only the loss of the crop for one year; and, if this should happen, the old stocks would not live; consequently the land would require trenching, paring, and burning and replanting the following year, the replanting alone costing something like £15 an acre, and still the risk of being eaten up afterwards.

"I am glad to say that little damage is being done *at present*, and the Willows are growing well; but, *from the quantity of* eggs and grubs showing on the leaves, I fear the outbreak will recur again in the course of a few weeks, when the Willows are tall and difficult to deal with.

"Picking has been the chief remedy resorted to, but I have got a ten-gallon can, made pretty much on the lines of the one recommended in a report you sent to Mr. Melvill for distributing Paris-green solution.*

* The method of operation alluded to is mentioned in Prof. Riley's 'Seventh Missouri Report' (1875, p. 15), and is as follows:—"It consists of a can capable of holding about eight gallons of liquid, and so formed as to rest easily on the back, to which it is fastened knapsack-fashion by adjustable straps, which reach over the shoulder and fasten across the breast. To the lower part of the can are attached two rubber tubes, which are connected with two nozzles or sprinklers. The inside of the can has three shelves, which help to keep the mixture stirred. There is a convenient lever at the bottom, which presses on the tubes and shuts off the outflow at will, and two hooks on the sides near the top on which to hang the tubes when not in use. On the top is a small air-tube and a capped orifice. Two bucketsful of water are first poured into the can, then three tablespoonfuls of good green, well-mixed with another half-bucketful of water, and strained through a funnel-shaped strainer, which accompanies the machine, and the use of which prevents the larger particles of the green from getting into the can and clogging up the sprinkler. Five to eight acres a day can readily be sprinkled by one man using the can, and from one to one and a half pounds of good green, according to the size of the plants, will suffice to the acre."

With regard to amount of Paris-green which may safely be used, it is stated that "when in liquid suspension (for Paris-green is insoluble in water) a half-pound may be mixed with forty gallons of water. Double this amount of green, or, in household measurement, a tablespoonful (a little over an ounce and a half) in a pailful of water (four gallons) is often used on many plants without injury when more active results are desired."—'First Annual Report of Consulting Entomologist of the State of New York,' p. 27.

The above proportion appears to be about a third weaker than that noted as mixed, consequently it would be as well to experiment as to desirable strength. The Paris-green being arsenite of copper, and consequently a *deadly poison*, requires to be kept and also mixed under careful supervision, especially if there are children about, as the beauty of the colour is very attractive. The price has been reported to me as 6*d*. per pound retail.—Ed.

"The Paris-green we had difficulty in getting, but a supply has now come to hand, and experiments are being made. One man dressed a few Willows three days ago, and he is sanguine of success. Growers are afraid to use this solution for fear of damaging the Willow, but so far their fears have proved groundless.

"As to the extent of the attack, I cannot say much farther than that in the district between Warrington and Lymm, a distance of five or six miles, all the Willows are affected pretty much alike. At Thelwall, which is about midway, the beetle has been troublesome for twenty years, but not until three years ago did it give any trouble in Lymm. About that time a few plants were affected adjoining the river; last year these plots were very nearly worthless, and other plots were attacked; and so the plague has spread.

"This year (1884) I have no doubt the exceptionally dry season has largely encouraged the increase of the insect. I am told that in Thelwall district* gas-lime, sulphur, hellebore, soot, &c., have been tried as preventives, but without any good effect, and hand-picking has been looked upon as the only remedy. I am sending some more specimens of leaves and grubs."

On the 24th of July, Mr. Cameron forwarded some more grubs of Willow Beetle, and concluded his series of careful notes with the information that the young Willow crop was then doing fairly well, and the beetles upon them doing little harm; but on two-or-three-year-old plants considerable harm was done.

The Paris-green had been most satisfactory of all the dressings which had been tried. "Indeed, *I believe by applying this dressing* early enough the beetle might be kept fairly well under, the difficulty at this season of the year being to get the wash distributed; the Willows grow so thickly on the ground and so high that any spray distributed cannot be used. I find the Willows are easily damaged if Paris-green is used stronger than the quantities given by Mr. G. Leigh in his notes. *I think our safety is in early spring work, and trapping of some amount in early winter.*"

On Jan. 24th of the present year, Mr. Cameron confirmed the correctness of the above views by the following report of the state of affairs up to that date, which, I should say, most especially showed the serviceableness of winter trapping on the broad scale in which, in a case like this, it can be carried out.

Mr. Cameron observes:— "Where diligent *hand-picking* was attended to, the crop of Willows has proved an average one; and where the *Paris-green dressing* was applied they have also proved a good crop. Where no remedial measures were adopted the growth

* See also previous report from Lymm, p. 94.

has been small, the stocks showing damage, and in many cases, I fear, they are ruined. A few growers have put down traps, in the shape of old posts and birch-wood bark up trees, &c., in the neighbourhood of the infested Willow beds, and under these traps the beetles have lodged in myriads, and are, of course, being destroyed; but they are mostly found lodged in retreats considerably above the flood-line, and in places where artificial flooding cannot be applied. The pests we find hybernating comfortably under the bark of large Willow trees which grow in considerable numbers along the line up the River Mersey, where the Willow beds are mostly located.

"The Lymm Local Board (of which I happen to be chairman) planted their *new* sewage farm with five acres of Willow last year, and we are arranging to plant six acres additional this spring. All this land is capable of being flooded with sewage, and the experiment will be tried systematically. I am very hopeful of a good result."

The notes referred to above were contributed by Mr. G. H. Leigh, a Willow grower at Lymm, who tried several experiments for the extermination or prevention of the spread of the Willow Beetles. He notes this beetle being furnished with wings to convey them to fresh Willow pastures, and that they commence their destruction upon the leaves when they first show shoot; after a while they lay their eggs, and thus leave their offspring to make a second destruction.

Mr. Leigh experimented by dusting soot on the plants, but the early part of the summer was so dry, with so little dew, that the soot did not remain on the leaves. He syringed them and dusted the soot, but this also was of no use. Hellebore powder was used with the same result, the leaves being too dry to receive it; but even when the effect was tried of putting the beetle into it (in a vessel) in a quantity beyond what could be put on the Willow plant, it took some fifteen minutes to destroy the beetle. Arsenic was also tried with the same results.

Paris-green "answered much better." Mr. Leigh mentioned that he then tried Paris-green, with about half an ounce to three to four gallons of water. The Willows by this time were grown three feet high; therefore he could not apply a good spray, but the application to the plants on the compass of ground sprayed with Paris-green *was successful.* It scorched the leaves a *little*, and made them curl, which he believed was the cause of the beetle removing itself; but "it did not injure the main shoot." Also, it is noted, "I cannot say it killed the beetle right out, as it immediately dropped to the ground, being always on the alert when anything touched the leaves."

Mr. Leigh says:—"*I am of opinion* that *all rubbish* brought by the winter floods should be destroyed, or buried deep enough so that the beetles could not harbour on the banks.

"I am also of opinion that Paris-green, if used early, would prevent, if not completely destroy, them; and if it was more used with a good spray it would destroy it in the early stage."

The following letter from Wigan gives some additional information regarding the life-history of the beetle, and the wide-spread and destructiveness of its attacks, and, like the others, dwells on the very important point of the beetles, which will form the spring attack, *sheltering themselves during winter in the neighbourhood.*

Mr. W. Worthington, writing from Wigan on the 28th of May, mentioned "that the Willow Beetle was doing much damage to the Willow crop in some parts of the country. Specimens were sent from Willow beds about ten miles from Wigan, which had suffered heavily in the previous year. The beetles had again attacked the Willows in great numbers, and a large staff of hands had been engaged in hand-picking. Many ways of getting rid of them had been tried, and paraffin oil had been found the most destructive, but unfortunately it also injured the plants.

"It was noticed that there were two visitations of the pest—the first in May, *when the old beetles* leave their winter-quarters; the second later in the season, just before the Willows begin to ripen. The insects then settle in vast numbers on the tender leaves and shoots of the plants, and in an incredibly short time do an immense amount of damage.

"*When the beetles* leave the Willow beds in autumn they conceal themselves in old fences, hay and corn stacks, crevices of old buildings, &c., where they pass the winter, and emerge to commence their depredations in the following spring, when the Willows have got into leaf."

The above letter was kindly forwarded to me by Mr. S. L. Mosley, from Beaumont Park, Huddersfield, with the mention that the Willow Beetle was very common in that neighbourhood, but on Poplars; and accompanying he forwarded specimens of the beetle and of injured Poplar leaf.

Now, looking over the results of the above observations, firstly as to what remedies have been tried and failed, the knowledge of which will save time and expense in future attack, it is noted that soot, sulphur, lime, and spent gas-lime, arsenic, and likewise hellebore, failed to do good.

Hellebore has not, as far as I see, been tried as a means of destroying the grubs, but Mr. G. H. Leigh's careful experiments appear conclusive as to its being useless for destroying the beetle. Paraffin is noted as of use, and hand-picking obviously cleared enormous quantities of the pests; but, as a direct remedy in the way of application to the Willows, Paris-green appears to have acted best.

This poison has the merit of being an application which has now been tried for many years, and found serviceable regularly on the vast scale on which it has been used in the United States to keep down Colorado Beetle, which is, like our Willow Beetle, a *Chrysomela*, and much like it in habits; and if during the time before the beetles come out some of the Willow growers were to have a tin can made on the plan of Mr. Cameron's, and learn where Paris-green was purchasable, as there is often great difficulty in procuring it on the spur of the moment, it would probably save much money in the end.

With respect to paraffin, it is worth consideration whether the soft-soap and paraffin washes, mentioned under the headings of Hop Aphis and Mangold Fly at pp. 54 and 66, would not be likely to be of great service.

In the mixture given as Mr. Shearer's recipe there is no difficulty as to separation of oil and soap; the can would give a proper method of application, and the stickiness of the soft-soap would ensure the leaves remaining (except in very wet weather) in a condition thoroughly repulsive to the beetles, whether for food or egg-laying.

The great point, however, is *forestalling attack*, and in the above observations with which I have been favoured it will be seen that the enormous importance of doing this by clearing away loose bark-rubbish, rubbish below flood-line, &c., is *again and again* dwelt on.

But there is yet another important point. This attack is one in which non-attention on a single Willow ground does mischief to all near. The Willow growers wisely formed themselves into a society last season to attend to the extermination of this pest, and the result has been, as shown above, that in a few months they have learnt its history, and what measures are or are not of service in checking the attack. If they should think fit to continue to thus co-operate at least for another season, so that they might be fully cognisant of the effects of all methods of treatment, and likewise of those of absence of attention to the subject in their district, the occasional time given to the meeting would certainly be repaid.

OBSERVATIONS

ON

WARBLE FLY OR OX BOT FLY,

Œstrus bovis, Clark; *Hypoderma bovis*, DeGeer.

Ox Warble Fly.

The following observations have been collected in order to place before those interested in the subject some amount of information in a form easy of access regarding the history of Ox Warble attack, and means found practicable and serviceable for its prevention in this country, at the present time, by our own agriculturists and cattle owners. Little has been written in connected form on this attack since the time of Bracy Clark's well-known treatise. German writings, especially those of F. Brauer, give much scientific information, but they are not easily accessible; and the following observations therefore have been courteously intrusted to me for publication with the view of drawing attention to the subject, and also of showing how the matter stands in our country without being encumbered by confusion from differences of climate, breeds, and treatment involved in working on foreign observation.

Warble attack is commonly known as consisting of swollen lumps —few or many—to be found chiefly during the months of April and May on the back or loins of the attacked animals, each swelling or warble containing a maggot or "bot," which lies with its black-tipped tail (often taken for its head) at a small opening in the swelling, and the other end (which contains the orifice which serves for a mouth) in a sore on which it is feeding in the under tissues of the hide.

The great injury, however, which is caused year after year by this attack is not only from the perforations of the maggots lessening the

value of the hides, but the loss in flesh and milk and health in summer, when the animals are started by their terror of the Fly to gallop as fast as they can go, and later on the suffering and drag on the system of supporting may be six, ten, or twenty, sometimes even more than a hundred, of these strong maggots growing up to an inch in length and feeding in the sore, which they keep up from January or February until they are full-grown.

We do not know with certainty whether the losses taken together amount, as estimated by Mr. Stratton, of The Duffryn, Newport, to a yearly sum exceeding *one million pounds sterling*, or the higher estimate of Mr. W. H. Liddell, of upwards of *two million* pounds sterling a year to Great Britain and Ireland; but it is demonstrable that the loss is very heavy, the suffering to the animals often very great, and it is equally certain that the attack might *be very greatly lessened, safely, cheaply, and without injury to the hide.*

The following notes will be found to be chiefly of methods of treatment found to answer, and of habits of the pest observed for practical service by known agriculturists and cattle owners, with additions regarding the condition of the maggot in the hide, and details of injuries to the leather, for which, together with specimens liberally supplied, I beg to offer my best thanks to all the contributors.

The subject is perhaps best begun at the stage at which it is most observed, by observations of methods by which *the maggot may be surely and easily killed in the warble*, followed by notes of *absence of attack where this course has been followed for years;* likewise some observations as to the *damage* to the health of the cattle from *inflammation and ulceration of the subcutaneous tissues;* of the prevalence of the attack on special ages and breeds of cattle, and notes showing that the warble with the maggot in it, though most prevalent in April and May, is to be found occasionally much later in the year.

Various applications and methods of treatment whereby the maggot may be killed in the warble.—(It should be observed relatively to destroying the maggot that it breathes or rather draws in the air necessary for it through the two somewhat kidney-shaped black spots, which are easily seen in the tip of the tail-end of the maggot in an advanced warble. If these "spiracles" or breathing-pores are choked the insect dies; consequently, if anything like tar or mercurial ointment, or other choking substance, is applied, the maggot is sure to be destroyed).

Maggots of Ox Warble Fly, full-grown, and about to change to chrysalis.

Piercing the warble is not so perfectly certain to kill it, as the operation is not always thoroughly performed. Of the various

applications noticed that of mercurial ointment appears the simplest and surest.

The first communication is from Mr. Stratton, of The Duffryn:—April 11th. "I have treated some warbles with acetic acid, some with tar, and some with *mercurial ointment;* I have not the slightest doubt but that all will be effectual. I am satisfied there will be no difficulty in killing the grub with any one of fifty simple remedies."—

About a week later Mr. Stratton added:—"I treated others with *mercurial ointment* (such as is used for scab in sheep); the effect of this is very remarkable, for in a couple of days after the application the grub appears to be quite decomposed; and I am persuaded that no remedy can be more safe, simple, and effectual than this. It would not cost twopence a head to treat all the cattle in the country in this way.

"It is quite easy to destroy the grub by a stab, but the cattle object to it; it appears to hurt them almost as much as a puncture through the skin. The objection to the scalpel, &c., is that when you treat an animal for this attack all the grubs are not in the same stage, and some have no orifice developed, or only a small one, through which it would be difficult to make an insertion; whereas, whether visible or not, a little of the ointment rubbed in would destroy the grub effectually.

"Tar had the desired effect in every case but one, and in that I think the hair kept it from the opening. Acetic acid was perfectly effective."—R. Stratton, The Duffryn, Newport, Mon.

"I beg to state that I find the *yellow mercurial ointment, Ung. Hydrarg. Nitralis*, will destroy the maggot of the Bot Fly when in the hide of the animal. It must be rubbed in slightly."—Joseph Addison, Mapledurwell, Basingstoke.

"In America it has been found that a little *mercurial ointment* applied to the swellings in autumn acts very well in killing the young *Hypoderma* larva, but the simpler and equally effectual way is to rub the back and sides, and especially the back, with pure kerosine oil."—Prof. C. V. Riley, Consulting Entomologist, Department of Agriculture, Washington, U.S.A.

"The smallest quantity of *mercurial ointment* (as much as a small pea) placed on the hole in the skin carries death within twenty-four hours. After applying the ointment to about forty-five cows, I cannot tell exactly the numbers that were in the cows' backs, but my impression is that there were seldom more than six in one beast."—E. E. McBride, Glendonagh, Middleton, Co. Cork.

May 4th. "The larvæ or bots of the Ox Bot Fly are now approaching maturity, and cutting their way through the hide of the animal, and forming the injury that fellmongers call 'warbles.' A

needle into every one carefully occasions not the least pain whatever to the animal, but by piercing through the body of the insect destroys it.

"I have often rid an animal of them, but only when tied; loose animals entail the trouble of securing them, and so on."—D. TURVILL, West Worldham, Alton, Hants.

Effect of removal or non-removal of Warble maggots on subsequent amount of Warble Fly attack.

The two following notes draw attention to the important point that, though warbles are often brought in on bought cattle, yet that the grub can be surely and certainly destroyed; and Mr. Milne's note shows the good effect of continuous attention. This is confirmed by Mr. Stratton's observation regarding absence of fly-attack after previous removal, and by the note of Prof. P. McConnell of the presence of attack where the grubs were not destroyed.

"Regarding the Ox Bot Fly, I may say that I have had none on my farm for at least ten years. My cattle are now never seen, with tails erected, running as fast as their feet can carry them. Purchased animals generally have these warbles in their backs; these we take good care to take out by making a small opening with a penknife and pressing out the worms. Thus we do not have the Bot Fly, neither does it seem to come from other farms."—JOHN MILNE, Mains of Laithers, Turriff, Aberdeenshire.

"I always notice that bought cattle, and especially those from Wales and the West Country, are more affected with warbles than our own. I am strongly of opinion that the best way of killing the grub is to rub some unguent on the surface of the lump-hole in spring. An old friend of mine always used McDougall's sheep-dip preparation for this purpose with good effect. This method, of course, leaves the hide injured by holes. If there is any chance, however, of exterminating the Fly, it is a feasible and right method."—Prof. H. J. LITTLE, Coldham Hall, Wisbeach.

June 25th. "My cattle away on the level are now being tormented beyond endurance; these were not treated for warble, because I knew that they would be surrounded by others that would be full of warbles; but here, where I had all the warbles destroyed, I have observed only one animal running from Fly, so far, though in other years they have suffered badly enough. This looks like the effect of treatment, and, if so, indicates that the Fly does not go far from its birth-place." — R. STRATTON, The Duffryn, Newport.

"Unfortunately I have never given the subject much attention; not that I have not had an opportunity, for out of sixty cows I should say that the larger half were infested, but simply that we take the

thing as a matter of course, allow the grubs to 'ripen' and fall out of themselves, when the skin heals up again. Now that you have called my attention to the subject, however, I will study it."—Professor McConnell, Ongar Park Hall, Ongar, Essex.

The following observations mainly refer to the amount of warble attack being influenced by the age, health, and method of treatment of the animal. —The first two notes draw attention also to the important point of the great suffering caused by the warbles, as shown by the ulceration and inflammation found within the hide, and the feverish state of the animal.

It will be observed that for the most part the attack is considered worst on young cattle, but it is by no means limited to these; and I have added (p. 106) a portion of a letter written by Mr. W. H. Liddell to the Editor of the 'Leather Trades' Circular' in 1878, as it gives the thread of connection to the previous notes, showing that exposure without possibility of shelter, weakness, and neglect are all *favourable to increase* of warble attack, whether in old cattle or young.

A few further notes of the use of mercurial ointment or of pricking the maggot are also given.

"I suffer very little from warbles on my own cattle, and I think it is owing to their being kept well; but those I buy in the spring are usually in a fearful state, *both from warble and from low condition*, and I have had them quite ill from the effects of these pests. I then find nothing like a good cooling drench, as they almost run to fever point." —E. R. Berry Torr, Westleigh House, Bideford, Devon.

"In the spring, when cattle are in the house, if the hand is pressed along the back, any warble can be easily detected, and might, I think, be as easily destroyed. A needle or sharp instrument (dipped in some acid or poison, if necessary) would be certain and effectual. If some such plan could be generally adopted, how soon *the flies would be thinned*, and their progeny prevented from preying upon future generations of cattle.

"The agony these poor creatures must endure when these great worms are feeding upon them must be terrible; doubtless numbers every year perish in consequence. I have many times in the spring of the year noticed hides taken from say two-year-old bullocks which have died, and have seen how the back has been *one mass of sores, the discoloured blood and matter* showing how intense *has been the inflammation.*

"The warble grub, as you will be aware, is enclosed in a cyst of cellular tissue, and I imagine it lives upon the pus or secretion which is set up by its presence. The tissues immediately below the hide are very vascular and very sensitive; the hide itself does not appear to be penetrated by blood-vessels, at least by none visible to the naked eye.

The worm must therefore have excellent feeding ground, and it lives and thrives, taxing doubtless the strength of the animal upon which it preys, but not in the majority of cases destroying its life. . . . . Cattle at the age of one or two years are most subject to attack."—JOHN DALTON, Wigton, Cumberland.

"Young (yearling and two-year-old) beasts are most subject to attack [of warbles], and shorthorns more so than the thicker-skinned Welsh or Scotch breeds; the hide of a Welsh 'runt' is quite twice as thick as that of a shorthorn bullock."—E. A. FITCH, Brick House, Maldon, Essex.

"This year (1883) seems to be an exceptional one as regards these flies, as I cannot remember another in which so few have been about, and for so short a time.

"My reasons for thinking that dirty farming contributes to the evil are these: I find almost every bull-hide warbled, and nearly all cows—particularly old cows—which, *judging by the hide, have been badly fed and kept*, and the young oxen and heifers, which have a *better keep* and better *groomed* appearance, are almost all free, or nearly so, from warbles at all times. I notice that nearly all kips (that is, hides off yearling cattle) that have died a *natural* death are covered with warbles. Are deaths of these almost calves to be attributed to the fact that the irritation they cause exhausts nature?"—H. C. HAINES, Newport, Mon.

Extract from Letter to Editor of 'Leather Trades' Circular and Review,' May 8th, 1878.—"Some say they find them [warbles] worst in poor cattle; others again entertain the absurd idea that cattle are in the best healthy condition when they have warbles. They are worst upon young cattle, if they strike, as they often do, when they are stirks six or eight months old. The infliction takes greater effect upon a young growing animal than upon one that is older and fuller in condition.

"And *why are bulls* so very subject to them? Because they are often fastened, and have no means of clearing themselves of the Fly when grazing, and in winter tied up without any attention paid to the state of their backs."—W. H. LIDDELL, Leather Market, Bermondsey, London, May 7th, 1878.

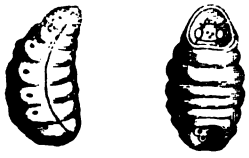
(The following observation regards amount of development of warbles varying in cattle which have been differently treated *after* being to all appearance exposed first to exactly the same amount of attack. This point and the cause is worth investigation.—ED.)

"Take half of a number of bullocks that have grazed together through the summer, and tie them in stalls in October or November for fattening, and leave the other half out in an open yard as stores, and you will find in January and February that not a single bot is to

be found in the stalled animals, whilst not one animal in the other lot is free from them."—D. TURVILL, West Worldham, Alton, Hants.

The following notes carry on the observations from the main time of the attack, to the maggots "leaving the cattle fast" in May up to the hides observed being almost free in July, and the last observation of maggots extracted from the warble on August 2nd.

May 15th. "I examined a byre yesterday near the sea, and failed to find a single warble. Next place I went to the cattle's backs, which were nearly covered. *The grubs are leaving the animals very fast now in this district.** As soon as the larva escapes you can squeeze a quantity of thin pus out of the cavity, and in some cases it is very thick and muco-purulent. On examining the backs of several carcases when the skin had been removed, I could not find any marks to show where the warbles had been. Some of the fleshers told me that at times they penetrate the flesh and spoil the sirloin."—H. THOMPSON, Aspatria.



Chrysalis of Ox Warble Fly, side view, and showing contained Fly.

July 9th, 1884. "At the present time hides are almost free from warbles, the worm having in almost every instance escaped. The last three weeks is the period (this year and in this part of the country) when the creature has made its exit. In two or three weeks after the escape of the worm the hole quite closes up, and the only trace remaining is the cicatrix where the wound has been. In some of the pieces of leather sent you might notice both holes and *marks;* the latter were the healed wounds of the previous year. A warble-hole, like any ordinary injury to the skin, though healed, can always be traced, and no matter how long the animal may live, the scar remains." —JOHN DALTON, Wigton.

"We are not so much troubled with Ox Warble Fly as in previous years. Yesterday (July 22nd) I carefully inspected a herd of sixty cattle; only one showed symptoms of having had the warble; out of

* When the warble-maggot is full-fed it presses itself gradually out of the opening at the top of the warble, which at first sight looks much too small for the exit, but the opening can be squeezed somewhat larger, the soft maggot is compressible, and is further helped in dragging itself out by the ringed shape and roughened skin, which prevent its slipping back again into its former hole. When it has fallen to the ground it creeps to some shelter, under a stone, a clod, or where may be convenient, and there the skin hardens into a chrysalis coat much like the grub, excepting in being dark brown or blackish in colour, and somewhat flattened on one side. From these chrysalids the warble flies come out, in favourable weather, in about four weeks from the dropping of the maggot from the back of the cattle; in cold weather the time required for the change is longer. For details of above see 'Essay on Bots,' by Bracy Clark; 'Monographie der Œstriden,' by Friedrich Brauer, and other writers.

six, four had left matter exuding from the wounds."—RALPH LOWE, Sleaford, Lincolnshire.

"I send you three warble grubs taken from the backs of dairy cows after a slight application of mercurial ointment to the holes in the skin. The date of extraction was the 2nd of August."—E. E. McBRIDE, Glendonagh, Middleton, Co. Cork.

Loss on Warbled Hides.

Up to this point the observations have mainly referred to the stage of attack in which the maggot is injurious to the hide, and the particulars on the annexed table, with which I have been favoured by the courtesy of Messrs. Fry and Company, Leather and Hide Factors, Moor Street, Birmingham, show the great money loss caused by even this one part of the effects of warble attack.

Particulars of seven weeks' supply of six classes of hides, being the total of each class of sound and warbled sold at two markets in Birmingham, commencing May 3rd up to and including June 14th, 1884, and showing the actual loss of each class of warbled hide:—

Six Classes of Hides. Weight from	Hides. No. of sound.	Hides. No. of warbled.	Sold at		Per hide less than the sound.	Loss on each Class. £	s.	d.
95 lbs. and upwards	286	67	¾d. per lb.	or	6s. 3d. per hide	20	18	0
85 lbs. to 94 lbs.....	446	222	⅞d. ,,	,,	6s. 7d. ,,	73	1	6
75 ,, 84 ,, ...	754	373	1d. ,,	,,	6s. 8d. ,,	124	6	8
65 ,, 74 ,, ...	881	579	1d. ,,	,,	5s. 10d, ,,	168	17	6
56 ,, 64 ,, ...	629	441	1d. ,,	,,	5s. 0d. ,,	110	5	0
55 lbs. and under ...	283	224	1d. ,,	,,	4s. 3d. ,,	47	12	0
Totals.....	3279	1906			Total.....	545	0	8

It will be observed that of the total number of hides (*viz.*, 5185) over one-third were warbled; and, looking merely at one line of the figures, it shows that out of 1460 hides, ranging from 65 lbs. to 74 lbs. weight, 579 were lessened in value at the rate of 1d. per pound, or 5s. 10d. per hide, giving a total loss on these of £168 17s. 6d.

The above table of particulars does not include the three classes known as "heavy" and "light" cows' and bulls' hides, which also were warbled, but the numbers of which were not taken, on account of Messrs. Fry not being as much interested in these as in the other classes. Enough, however, is noted to supply a scale which, if applied to the returns of the other hide markets, would give a fair idea of the extent of what is in truth the *enormous waste* which is going forward, as there is not the slightest necessity for warble attack being permitted to run on unchecked. Further, this depreciation in the value of these hides is unmistakable evidence of there having been

presence of *inflammation, and of maggot-sucked sores* running an inch or more in the under tissues of the hide, causing a loss in the benefit of food and health (with further details I need not enter on here), and a *course of suffering* to the animal which certainly calls for the general attention which many of our leading cattle owners and farmers ask for.

Section of Warble, slightly larger than life.

In reply to enquiries regarding damage from Warble Fly and amount of hides injured, Mr. C. Haines favoured me with the following observations and approximate estimate :—" I seldom see much of the warble in the pelts, excepting during March, April, and May; so it would seem, in the early stage of its propagation, that it would not materially affect the hide, however much it might injure the health of the beast which afforded it a temporary shelter.

" The following information must be taken as the result of my observation here; the effects would probably vary considerably in different parts of the country, as I should say *temperature* and *cleanliness* in farming would have much to do with it.

" I usually commence to notice them as April comes in; for about a month I should judge 50 per cent. to be damaged, for the next two weeks say 20 per cent., and for one month additional say 10 per cent.; allowing thus liberally should about cover the year's damage."—H. C. HAINES, Newport.

Notes of amount of injury to imported Hides.

I am indebted to the courtesy of the Colonial Company for favouring me with the following reply to my inquiry as to attack on imported hides. On the 8th of August Mr. B. Brown, Secretary, wrote me :—

" I enclose copy of reply I have just received from an experienced firm of hide and skin brokers to an inquiry we made of them as to the injury done to hides, &c., by the Warble Fly."—B. BROWN, Sec.

" Reply to the inquiry of the Colonial Company respecting the damage done to hides and skins by the Warble Fly :—

" ' Parcels of ox and cow hides and goat and sheep skins coming from all parts of the world, all contain a varying proportion of warbled hides and skins, the damage, as a rule, being greatest on those from the hottest climates, and generally affecting goat skins to the greatest extent.

" ' Those hides and skins coming from Mogador and other northern parts of Africa suffer most in this respect, an average perhaps of about one-fourth of them being damaged to the extent of 60 or 70 per cent. Those from Kurrachee also suffer damage to almost the same extent,

while those from Calcutta, Madras, and Bombay are depreciated perhaps to the extent of 50 per cent. on 10 per cent. of the skins.

"'From Cape Colonies the damage is comparatively slight, and still less in those hides and skins from Australia and South America.'"—Communicated by Sec. of Colonial Co., Leadenhall Street, London.

The following note, from personal observations by Mr. D. Byrd, gives *approximate estimates of loss of value on growth of feeding cattle* from disturbance, and on *weight of cheese and percentage of milk* calculably lessened by the same cause:—

"We all know to our cost how greatly these tormenting flies irritate and madden the cattle, causing them to gallop or run, as if for their lives, to get away from the buzz and presence of their tormentors. Feeding cattle cannot grow in flesh without quiet and rest, and milking cows must suffer to a greater extent than we are aware of. To use a common remark, they soon 'bate'—give less milk. To drive a cow fast, or cause her to be excited, reduces the quantity and quality of the milk. Without perfect quiet and rest they cannot do their best for us.

"This leads me to the one important point. What is our loss in the cheese-tub caused by the Warble and Gad Fly? I have tried to estimate the loss during the four or five summer months, or even the eight months that a cow is supposed to be in profit. There are certain times of unrest when the cow will give about one-half of her usual flow of milk. These tormenting flies, and the continued presence of the prickly-coated warble maggot, must keep up a perpetual uneasiness, and retard the growth of our feeding cattle to our loss, it may be, of £2 per head. In the dairy cows the loss will be greater. The daily loss of milk may make a difference of 1 cwt. or ¾ cwt. of cheese per cow per annum. Half a hundredweight, or 12½ per cent., of milk less in a dairy making 4 cwt. at 70s., comes to 35s.; but 12½ per cent. is too low an estimate: it may in some cases be put at £3 per head, and in a dairy of 100 cows would show a loss of £300."* — D. Byrd, Spurstow Hall, Tarporley, Cheshire.

* The above note also formed part of a paper communicated by Mr. Byrd to the 'Chester Chronicle' of Feb. 7th, 1884. Mr. Byrd's mention of "the Warble *and* Gad Fly" is very important, as these two very different attacks are often confused. The Gad Fly, *Tabanus bovinus*, is much larger than the Warble Fly, and injures the animals by driving its sucking apparatus into them very painfully and drawing away the blood, and also, like the Warble Fly, by terrifying them into the wild gallops we know so well. From some of the subsequent observations given on p. 113 it appears that the applications noted as useful to keep off one sort of Fly are equally useful to keep off the other; and this point of the cattle so dressed being able to feed in peace whilst the others were being hurried in all directions is well worth consideration.

Summer attack.

About four weeks after the maggots have been noticed leaving the backs of the cattle the summer attack from Warble Fly may be expected to begin, and to be great or small in amount according to the number of maggots which were allowed to live.

The Warble Flies are about half an inch long, striped or banded with different coloured hairs so as to look not very unlike light-made Humble Bees. They have larger heads, with yellowish faces, the body between the wings yellowish before and black behind, and the abdomen banded successively with white, black and orange, the orange being at the tip. The two wings are brown, *without spots*, the legs black, with pitchy or red feet.*

The egg is stated to be white and oval, with a small brown lump-like appendage at one end. How the animal is "struck"—that is, how the egg is attached to it—is not yet proved. (For references regarding this point, see Index).

The following observations note the date of attack as being chiefly in July and August :—

"The period they [the Warble Flies] annoy the Ox and deposit the eggs in this climate is from the middle of July to the middle of August."—JOHN MILNE, Mains of Laithers, Turriff, Aberdeenshire.

"In this part the perfect insect generally deposits its eggs about lea-hay time, July and August, and from the way the cattle (young ones two and three years old particularly) gallop through the pastures with tail erect, I am inclined to think that the ovipositor pierces the skin, and the egg is deposited within the skin. Nothing seems to be seen till March, when the little swellings are observed on the cows' backs, and during April and May the larvæ leave their winter-quarters and fall to the ground."—HENRY THOMPSON, Aspatria, Cumberland.

. . . . . "It appears that the Fly during the summer deposits its egg in the skin on the back of the ox, and during winter several little lumps make their appearance on the animal's back, and about April and May a little hole is observable in each little lump ; and I have at this time squeezed a great many of the bots through the holes."—J. B. SCOTT, Sutterton Grange, Spalding.

August 8th. "Cattle are suffering very much at this time from the Fly. Fancy a fat beast having to run perhaps ten miles a day in

* For details see authorities cited at the end of this paper. It may assist those who wish to secure specimens of the Fly to mention that the best method appears to be to fasten a small stout gauze or muslin bag by means of a ring of tar on the infested animal just when the warble is what is termed ripe. The maggot will drop uninjured into the bag, and, if lightly covered with earth in a wide-mouthed bottle with a gauze over the top (or, better still, covered with earth *out of doors*, and an old gauze dish-cover set over it), the Fly will most likely, in due season, be secured. This species is very difficult to procure from entomological dealers.

this heat! Many lose £1 worth of beef in a week from this cause. —R. STRATTON, The Duffryn, Newport, Mon.

. . . . . "In the hot summer days our cows are tormented by the Fly, and we frequently see them galloping with tails up to get out of the way of their tormentor; this lessens the quantity of milk, and prevents feeding cattle growing." — D. BYRD, Spurstow Hall, Tarporley.

In the following notes of applications or treatment of the animals, which have been found to *prevent* attack, it will be seen that there are a few special points acted on. These are—*1st, applying mixtures of such a strong smell as may be obnoxious to the Fly and overpower the attraction of the smell of the animal; 2nd, applications which would stick the Fly fast or kill the egg; 3rd, washes which would clear off the eggs or destroy them if laid on the skin, or if lying just beneath the outer cuticle; 4th, protection afforded to cattle by being housed at egg-laying time.*

"Respecting the application of anything to prevent the Warble Fly depositing the eggs, there are a number of matters of a tarry nature that might be applied, and nothing better than Stockholm or green tar itself rubbed along the cows' backs before turning them out, which would last all the summer season, or applied in May or June between the top of the shoulder-blade and loins. This is the only part the cow cannot lick, rub, or lash with the tail; hence the only *peaceable* place where the Fly can leave its egg. Or sheep-salve (bad butter and tar mixed with sulphur). About two applications would last a full season. Or the application of brine and the mixture I have already given you. Paraffin, kerosine, carbolic acid, phenyle, &c., are all too transient to be of much service, and would have to be applied frequently." — H. THOMPSON, M.R.C.V.S., Aspatria.

Mr. Thompson further notes that he has been told it was a common practice to wash the cows' backs with pickling brine, the application being used two or three times during the season. In this part large farmers keep what is called the pickling-tub, wherein they put beef and mutton; the brine is made with salt and water, salt being added till an egg will float. This is an old remedy, and I think a good one, as I think the ova would be destroyed immediately it was placed in the skin.

"I have used and also recommend the following mixtures as a preventive:—Flour of sulphur, 4 oz.; spirits of tar, 1 gill; train (whale) oil, 1 quart. Mix well together, and apply along the spine of the cow once a week with a small brush. The smell drives off the flies, and prevents them depositing their eggs, and the cattle are left *at peace* to graze, and warbles thus prevented."—HENRY THOMPSON, Aspatria.

"I venture to give my experience of many years. If cattle that

are turned out into the fields (those that are in sheds escape entirely with me) are rubbed all down the spine with train oil, and a little also on the loins and ribs, they will be free from this pest, have their hides uninjured, will do much better, and will graze quietly at the time that others not so treated are tearing about with their tails in the air.

"Two or three dressings I generally find enough, but much depends on the season and the thickness of the 'coat.'"—B. St. John Ackers, Prinknash Park, Painswick.

The following observations, received on Feb. 25th, confirm the use of the mixtures of the nature of those above noted, by absence of attack being *now* found to be following their application, whilst other cattle at the same place are showing warbles:—

Feb. 23rd. "Last summer we had twenty-eight two-year-old heifers on an outlying field: they showed symptoms of ringworm got from neighbouring stock. I took the twenty-eight into a house and applied the following wash to them, rubbing the entire back once:—Spirit of tar, carbolic acid, sulphur, and linseed oil (I am now sorry I did not measure the proportions of the mixture, but I merely made it sufficiently strong to counteract the ringworm).

"The result is, I have not one case of warbles amongst the twenty-eight heifers. I have it on others, and used to have lots of it on the two-year-olds. As I believe the spirits of tar, carbolic acid, and oil kept the warbles off, I shall try it again. Meantime, I should like, if others would try it as well as myself, to test it thoroughly."—D. Sym Scott, Ballinacourte, Tipperary.

In the first line of this page is an observation as to cattle which are *always* in sheds at egg-laying time escaping attack. It would be very useful to have more information as to the condition of cattle which had access at will to the shelter of sheds in the heat of the day.

At Sedbury Park, in Gloucestershire, where I have seen our cows in exposed pastures going at the swinging trot that shows fly-attack, I never saw this in one field where there was a thick open grove of oaks with a shed beneath it, within and round which the herd sheltered themselves and picked the hay that might be strewn about.—Ed.

The following note refers to this point, and likewise to *housing at night*, which has not been brought forward before, and may prove important relatively to some of the *Œstridæ* being exceedingly lively in the bright moonlight:—

"I seldom get any warbles in my own young cattle, and I think from this cause,—that *they have sheds to run under during the summer, and are housed at night*, and have a good feed of cake; and my belief is that flies of any sort always prefer *working* on poor half-starved things to well-fed ones."—E. R. Berry Torr, Westleigh House, Bideford.

The following notes confirm the opinion (brought forward, I believe, first by Bracy Clark, and held by many writers) *that the Warble Fly does not follow the cattle over water, consequently that allowing access to shallow pools is a great preservation from attack:—*

June 28th. "During the recent hot weather I have frequently seen my feeding bullocks suddenly gallop off, with their tails erect, and rush into the nearest water, where they seem to be less tormented by the flies."—J. B. Scott, Sutterton Grange, near Spalding.

"The amount of warbles on an animal and amount of warbled animals in a herd will be rather difficult to arrive at, but I would say from fifteen to twenty warbles on the back of each animal,—that is, grazing on lands well sheltered with trees; but where there are *good large ponds, and the animals go into the water and stand during the hottest part of the day, they are not so rife.* From what I can gather, as well as from observation, I find the Warble Fly will not cross any extent of water."—H. Thompson, Aspatria, Cumberland.

"Our cattle do not suffer much, but then we have plenty of marshy ground close at hand, and a good deal of timber which affords shade."—Prof. W. Fream, College of Agriculture, Downton.

The main points of the preceding observations taken in order show the following results:—1st. That when the warble is seen in what is its common condition in April and May, the maggot within can be killed (by various applications specified) both surely, easily, and without injury to the health or hide of the animal or much outlay to the owner.

2nd. That where this plan has been adopted there is found to be absence, or very slight presence of, warble-attack; and on the other hand, where warble grubs have not been destroyed, the cattle have been found to be attacked as a regular thing.

3rd. With regard to Fly-attack in summer, notes are given of applications whereby the cattle have been preserved from injury and from the terror of the Fly; likewise notes are given of the use of shelter during the time of Fly-attack, and also of the serviceableness of access to shallow water as a protection from the pest.

4th. It appears certain that in this country the open warble is not generally seen until at least some way on in the month of February.

Other points of interest are given, especially some reliable details and estimates of loss, which well deserve consideration; but besides the above notes we need to know more from observations of the live maggot, as to its method of growth, and the manner in which this causes the warble. A few specimens of exceptionally early appearance of the maggot swelling *beneath* the hide, and also of perforated swelling showing *outside*, were forwarded me, from which I give the following notes, which it is purposed to complete as the coming season may give

opportunity, and to publish with all the details, illustrated by figures from the specimens.

First observation of young Warble beneath the flesh side of the Hide.

On Nov. 12th of last year a cutting from a yearling skin brought in that day was forwarded to me by Messrs. C. and H. Hatton, Barton Tannery, Hereford, with the note that they considered it showed first symptoms of warble maggot. This piece of hide was about 12 in. by 4 in., and on the *flesh side* there were upwards of seven slight swellings about a quarter of an inch across, of a livid or bluish colour, each forming a raised centre to greatly-inflamed patches. Within the blue centre I found a small warble maggot, just large enough to be distinguished by the naked eye when removed, but not plainly so whilst in the swelling, as the inside of this was of blood-red tissue, and *the small maggot was blood-red also.* Under the microscope it was easily distinguishable by its patches of minute prickles, but I was not able to remove one specimen quite entire. From the red mass or maggot-cell I found that a fine channel passed up through the hide to the surface. The course of this channel was easily traced by the blood which in handling the specimen was pressed from below along this gallery till it came out in a little drop on the outside of the hide. This passage of blood or matter appeared to have been going on previously in the natural course of things, for I found some specks of dried matter on the outside of the hide. It is important to observe that these channels varied in direction,—one was straight through the hide, another slanting, and another went up *nearly* to the outer part of the hide and there *turned* and went a little way just under the cuticle, and ended in a small cavity just below the surface.*

From the presence of these *small cavities just below the cuticle*, and

* It is a curious coincidence that just about the time when the first appearance of the live maggot was observed, as noted above, information from at least three localities was sent in of small lumps or warbles being produced so far that they could be felt on the backs of cattle, but which did not advance further in growth. Whether these were warble swellings, or were abortive warbles,—that is, swellings beneath the hide in which, from some cause unknown, possibly from unseasonable development, the maggot had died,—I cannot be certain, as being on living cattle examination was impossible. On one hand, some of the first observations of open warble in spring were taken from these cattle; on the other, a good many specimens of small swellings or tumour-like lumps formed on the flesh-side of removed hides were also sent me, which might be the cause of outside lumps. These contained maggots so completely and tightly grown up in the tissues that there was no communication with the hide. The maggots were of various ages up to approximately a quarter grown, and had obviously been long dead from the perished state of the internal organs; and it would be of considerable interest to know whether the death of these maggots was from unseasonable development or from some cause we could follow up serviceably.

the fine canal running downwards from them or from the surface, as the case may be, to the young warble cell beneath the hide, I think we shall find the egg is fixed just *beneath the cuticle*, and that *the young maggot* works its way through the hide to where we find it in its early stage. It does not seem to me *possible that the Fly could pass the egg* through the hide by means of her egg-laying apparatus (or ovipositor), because, as observed, the passage down to the maggot-cell is sometimes of a shape that *could not* have been caused by the ovipositor.

This matter is by no means of mere scientific interest, for the fact of the egg lying just below the uppermost film of skin (or cuticle), and the maggot leaving an open channel behind it, whereby poisonous washings or dressings will reach it, or may choke up its breathing apparatus, is very important practically.

In the earliest stage in which I have as yet had specimens of the maggot I found the openings of the breathing apparatus varied from the adult form.

First observation of open Warble swelling.

The first note of appearance of the open warble was sent to me on Jan. 27th of this year from Wigton, Cumberland, by Mr. John Dalton, to whom I have especially to offer my thanks for his continuous observations from the end of August in 1884, which have clearly shown the serviceable fact that up to the date above given the warble was not noticeable, for practical purposes, in open condition.

On Jan. 27th Mr. Dalton wrote :—" I have to-day noticed, for the first time this season, the appearance of the young warbles. I found them in two different hides, both off young cattle of from one to two years old. . . . . *The round hole in the hide is distinctly visible.*"—JOHN DALTON, Wigton, Cumberland.

The first general observation of the appearance of the warble as a swelling, or in open condition, began at the middle of February. On Feb. 14th Mr. E. E. McBride wrote from Glendonagh, Midleton, Co. Cork, that " the lumps were increasing in number and size on his cattle " ; and on the same day Mr. Byrd, Spurstow Hall, Tarporley, Cheshire, after examination of the swellings on the cattle, mentioned that " some appeared to be soft lumps resembling a soft gathering coming to a head."

On Feb. 18th Messrs. Hatton, of Hereford, mentioned that they had received an ox-hide with many warbles in it, specimens of the maggots from which were forwarded ;* and on the previous day they had informed me that notice had already been given that hides on Birmingham Market would be sorted for warbles, and those having more than three would be out-classed.

* The cost of this hide was 29s., whereas the value of the same weight of hide free from warbles would have been 35s. 5d.

On the 20th I had the satisfaction of being able to examine the warble myself, in young open condition, in the hide of a Hereford which had been removed from the animal that day near Isleworth.

On Feb. 23rd (as referred to at p. 113), Mr. D. Sym Scott reported from Ballinacourte, Tipperary, that the warble had appeared on some of the cattle (though not on the twenty-eight which had been dressed).

On Feb. 24th Mr. H. Thompson, M.R.C.V.S., Aspatria, Cumberland, reported that he had found several small enlargements on young cattle, but no external opening; likewise that some of the boys of the School of Agriculture had that day found several enlargements on the backs of young cattle at the farm; and another reported small lumps on his father's cattle with black spots in the centre, covered with a gummy matter.*

On the following day Mr. Thompson reported that he had examined a large number of young cattle rising two years old, and found them well covered with the warbles in various stages; "some of them have twenty enlargements on the back, all showing the external opening."

Mr. Thompson favoured me, at the same time, with specimens of maggots, which show some important points which I believe have not been hitherto brought forward.

The warble maggot, when full-fed, and for much of its previous life, is well known to be of a bluntly oval, somewhat compressed, shape, of various shades of colour, from whitish to deep grey, and marked with cross-bands, which, under a magnifier, are seen to be formed of minute prickles. The maggots (as far as I am aware) in this condition have always an opaque skin. Earlier, however, in the condition in which they are observable by the naked eye at the time the warble is first opening, I find the form and texture of the maggot is very different.

The smallest which I have examined in this state was about a quarter of an inch long by a third of that width, not oval but straightish, or somewhat worm-like in shape; when older they became rather enlarged towards the mouth-end, so as to be of a long pear-shape, and in this condition, excepting dark cross-bands extending about a third round them, they were white and partially transparent. Whilst these small maggots were still apparently alive they were *hard*, and externally (over almost all their surface) *of glassy smoothness*. These conditions, joined to the peculiar shape and somewhat pointed

* I take pleasure in drawing attention to the above observation of the boys of the Aspatria School, as it shows the amount of intelligent interest and good serviceable observation which could be brought to bear on these subjects by our lads and young men throughout the country, if they were furnished with a *plain*, as well as a sound, foundation to work on.

ends, or end (according to age), adapted them most perfectly, in the first stage, for "travelling," in the second for pushing themselves up small end foremost, armed with the minute hard spiracles, through the opening warble.

As far as I see at present the changes of condition I have mentioned above are rapidly gone through, and, when the maggot has gained about a quarter or third of its growth, the spiracles are developed to an angularly kidney-shaped form, and the maggot assumes the compressed oval shape in which it is best known. It is still white, but opaque, and with the segments well-marked; *it has no occasion now to bore its way, and ceases to be furnished with a form fitted for perforation.*

On placing the very young maggots in water they swell so much as to become exceedingly rigid, and so transparent that much of the internal structure could be plainly seen.

By microscopic investigation the spiracles—that is, the blackish kidney-shaped spots which are seen at the tip of the maggot in the open warble—have two, and I think three, different successive forms before developing to the final and best known state; and they also differ from each other in the amount of spiracle exposed at the tip of the grub.

The breathing apparatus consists of a trachea, or breathing-tube from each of these spiracles or breathing-pores, and from each trachea a series of lesser and lesser tubes carries the air through the maggot. The two principal tracheæ are tied together near the spiracles by another short one, which forms a kind of bridge, or rather tunnel, of communication, and thus insures air supplies being continued if one spiracle should be choked. I also find that the young maggot possesses (apparently as an instrument for tearing out food) a pair of crescent-shaped forks or diggers. These are of such excessive minuteness that they are only to be found with difficulty, and I have not as yet found them in any but very young maggots. A fairly high magnifying power is needed for distinguishing their shapes; in my own case I have used a quarter-inch glass.

The difference in appearance, and especially in their *glass-smooth rigidity*, is so great between the young maggots when alive and fully inflated, and after death, when their flaccid condition conveys no idea of what their piercing powers have been, that I submit the above observations as being not merely of scientific curiosity, and hope to complete the investigation, and offer it in due time with illustrative figures. The above points seem to me to throw light on the probable method of *formation of the opening* of the warble through the hide. I do not find this passage (in great contrast to what is below) to be ulcerated or torn; it is merely a clean passage through the hide, smooth and shiny, as might be expected to be made by the pressure of

the growth of the smooth rigid maggot. In my investigations of yet earlier conditions I always found a minute channel from the outside of the hide to where the embryo maggot lay in the tissues beneath, and it appears to me that the enlargement of this passage by the young maggot forcing itself, small end foremost, up the ready-made tunnel, with its first spring growth, and, gradually enlarging the hole by the pressure of its own intensely hard, inflated, and rapidly enlarging condition, is the cause of the warble hole.

Disorganised tissue and ulcerated matter are sometimes dragged into the passage by the maggot, and in the opening of the warble we sometimes find a slight covering of gummy matter over the tip of the maggot, but the great mischief from inflammation, swelling, and disorganisation is beneath the hide.

The above refers to the first state of the passage of the *opening* warble. In a short time the maggot is to be found advanced to its oval form, and the passage through the hide to be then covered with a coating of some kind of skin, or lining membrane.

On the 3rd of March Messrs. Hatton further favoured me with a piece of heifer hide, less than six inches square, containing twelve or more warbles, which had now advanced in growth, so as to show on the flesh side of the hide as well-defined lumps, ranging from three- to five-eighths of an inch across, and up to as much three-eighths of an inch in height of the swelling.

All that I examined had openings on the upper side of the hide, and internally were now coated with a distinct formation of some kind of lining membrane, like thickened yellowish skin, continuous with the coat of the cell below. As I am not an anatomist, and the nature of this formation has been made the subject of minute German investigation and discussion, I merely mention its appearance, and refer to the figure, p. 109, drawn from a fully-developed cell last year.

Within the cells (in the hide above mentioned) the maggots now lay, still whitish, and hardly a quarter of their full size, but advanced to the compressed oval form, with broad and narrow bands of prickles, with kidney-shaped spiracles, and with the mouth end downwards in the ulcerated matter in which they were feeding.

This brings the investigation round to the point at which we started,—that of the maggot lying at our disposal in the open cell; for, whatever more we may find out, the great point of all that we are aiming at is *how to destroy the pest;* and I fully believe that as a beginning, if all who have cattle would have the warbles dressed with *mercurial ointment*, the benefit would be enormous.

I am greatly indebted to my contributors for the kind courtesy with which they have assisted this investigation, and, if they will be kind enough to continue their help for a few months longer, we might hope

to have the good results of stamping out warble attack whilst still in maggot-state clearly shown. The one point which as yet has not been observed is where the egg is laid, or rather how it is placed on or in the hide. This is not very important, but any observations bearing on prevention, or on points connected with this attack, will be gratefully received.

Those observers who may wish to study the minute scientific description of the *Œstridæ* will find excellent information in 'Monographie der Œstriden,' von Friedrich Brauer; descriptions, with serviceable life-histories, of the *Hypoderma bovis* are given in 'Praktische Insekten kunde,' von E. L. Taschenberg, part iv., pp. 84, 85; and the foundation of a large proportion of the information usually met with—that is sound, plain, and of practical use—is to be found in the 'Essay on Bots of Horses and other Animals,' by Bracy Clark, F.L.S., published in 1815. But our present research is putting the matter on such a practical and demonstrable footing from what we can all see in our own country, that I venture to submit to those who refer to me relatively to study of the subject that observations from life, both of the attack and of successful treatment, are of far more value than any quotation from already published books.

ELEANOR A. ORMEROD,
Hon. Consulting Entomologist of the Royal Agricultural Society of England.

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1885.

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Page 86, line 26, for "Squills" read "Leeks."

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